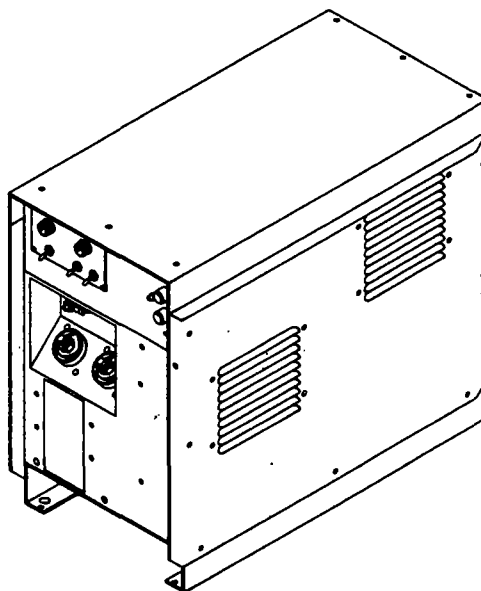




September 1989 FORM: OM-126 853A

Effective With Serial No. JJ401061

**MODEL: ARC PAK™ 350**  
**Manufactured For Chicago Bridge & Iron**



# OWNER'S MANUAL

**IMPORTANT:** Read and understand the entire contents of this manual, with special emphasis on the safety material throughout the manual, before installing, operating, or maintaining this equipment. This unit and these instructions are for use only by persons trained and experienced in the safe operation of welding equipment. Do not allow untrained persons to install, operate, or maintain this unit. Contact your distributor if you do not fully understand these instructions.

**MILLER ELECTRIC Mfg. Co.**  
A Miller Group Ltd. Company

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PRINTED IN U.S.A.

# LIMITED WARRANTY

EFFECTIVE: MARCH 15, 1989

This warranty supersedes all previous MILLER warranties and is exclusive with no other guarantees or warranties expressed or implied.

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Except as specified below, Miller's warranty does not apply to components having normal useful life of less than one (1) year, such as spot welder tips, relay and contactor points, MILLER-MATIC parts that come in contact with the welding wire including nozzles and nozzle insulators where failure does not result from defect in workmanship or material.

Miller shall be required to honor warranty claims on warranted Equipment in the event of failure resulting from a defect within the following periods from the date of delivery of Equipment to the original user:

1. Arc welders, power sources, robots, and ..... 1 year components
2. Load banks ..... 1 year
3. Original main power rectifiers ..... 3 years (labor – 1 year only)
4. All welding guns, feeder/guns and torches ..... 90 days
5. All other Miller-Matic Feeders ..... 1 year
6. Replacement or repair parts, exclusive of labor ..... 60 days
7. Batteries ..... 6 months

provided that Miller is notified in writing within thirty (30) days of the date of such failure.

As a matter of general policy only, Miller may honor claims submitted by the original user within the foregoing periods.

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ANY EXPRESS WARRANTY NOT PROVIDED HEREIN AND ANY IMPLIED WARRANTY, GUARANTY OR REPRESENTATION AS TO PERFORMANCE, AND ANY REMEDY FOR BREACH OF CONTRACT WHICH, BUT FOR THIS PROVISION, MIGHT ARISE BY IMPLICATION, OPERATION OF LAW, CUSTOM OF TRADE OR COURSE OF DEALING, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR PARTICULAR PURPOSE, WITH RESPECT TO ANY AND ALL EQUIPMENT FURNISHED BY MILLER IS EXCLUDED AND DISCLAIMED BY MILLER.

EXCEPT AS EXPRESSLY PROVIDED BY MILLER IN WRITING, MILLER PRODUCTS ARE INTENDED FOR ULTIMATE PURCHASE BY COMMERCIAL/INDUSTRIAL USERS AND FOR OPERATION BY PERSONS TRAINED AND EXPERIENCED IN THE USE AND MAINTENANCE OF WELDING EQUIPMENT AND NOT FOR CONSUMERS OR CONSUMER USE. MILLER'S WARRANTIES DO NOT EXTEND TO, AND NO RESELLER IS AUTHORIZED TO EXTEND MILLER'S WARRANTIES TO, ANY CONSUMER.

## RECEIVING-HANDLING

Before unpacking equipment, check carton for any damage that may have occurred during shipment. File any claims for loss or damage **with the delivering carrier**. Assistance for filing or settling claims may be obtained from the distributor and/or the equipment manufacturer's Transportation Department.

When requesting information about this equipment, always provide the Model Description and Serial or Style Number.

Use the following spaces to record the Model Designation and Serial or Style Number of your unit. The information is located on the data card or the nameplate.

Model \_\_\_\_\_

Serial or Style No. \_\_\_\_\_

Date of Purchase \_\_\_\_\_

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## SECTION 1 – SAFETY RULES FOR OPERATION OF ARC WELDING POWER SOURCE

### 1-1. INTRODUCTION

We learn by experience. Learning safety through personal experience, like a child touching a hot stove is harmful, wasteful, and unwise. Let the experience of others teach you.

Safe practices developed from experience in the use of welding and cutting are described in this manual. Research, development, and field experience have evolved reliable equipment and safe installation, operation, and servicing practices. Accidents occur when equipment is improperly used or maintained. The reason for the safe practices may not always be given. Some are based on common sense, others may require technical volumes to explain. It is wiser to follow the rules.

Read and understand these safe practices before attempting to install, operate, or service the equipment. Comply with these procedures as applicable to the particular equipment used and their instruction manuals, for personal safety and for the safety of others.

Failure to observe these safe practices may cause serious injury or death. When safety becomes a habit, the equipment can be used with confidence.

These safe practices are divided into two Sections: 1-General Precautions, common to arc welding and cutting; and 2-Arc Welding (and Cutting) (only).

Reference standards: Published Standards on safety are also available for additional and more complete procedures than those given in this manual. They are listed in the Standards Index in this manual. ANSI Z49.1 is the most complete.

The National Electrical Code, Occupational Safety and Health Administration, local industrial codes, and local inspection requirements also provide a basis for equipment installation, use, and service.

### 1-2. GENERAL PRECAUTIONS

**Different arc welding processes, electrode alloys, and fluxes can produce different fumes, gases, and radiation levels. In addition to the information in this manual, be sure to consult flux and electrode manufacturers Material Safety Data Sheets (MSDSs) for specific technical data and precautionary measures concerning their material.**

#### A. Burn Prevention

Wear protective clothing-gauntlet gloves designed for use in welding, hat, and high safety-toe shoes. Button shirt collar and pocket flaps, and wear cuffless trousers to avoid entry of sparks and slag.

Wear helmet with safety goggles and glasses with side shields underneath, appropriate filter lenses or plates (protected by clear cover glass). This is a **MUST** for

welding or cutting, (and chipping) to protect the eyes from radiant energy and flying metal. Replace cover glass when broken, pitted, or spattered. See 1-3A.2.

Avoid oily or greasy clothing. A spark may ignite them.

Hot metal such as electrode stubs and workpieces should never be handled without gloves.

Medical first aid and eye treatment. First aid facilities and a qualified first aid person should be available for each shift unless medical facilities are close by for immediate treatment of flash burns of the eyes and skin burns.

Ear plugs should be worn when working on overhead or in a confined space. A hard hat should be worn when others work overhead.

Flammable hair preparations should not be used by persons intending to weld or cut.

#### B. Toxic Fume Prevention

Severe discomfort, illness or death can result from fumes, vapors, heat, or oxygen enrichment or depletion that welding (or cutting) may produce. Prevent them with adequate ventilation as described in ANSI Standard Z49.1 listed in Standards Index. NEVER ventilate with oxygen.

Lead -, cadmium -, zinc -, mercury -, and beryllium-bearing and similar materials, when welded (or cut) may produce harmful concentrations of toxic fumes. Adequate local exhaust ventilation must be used, or each person in the area as well as the operator must wear an air-supplied respirator. For beryllium, both must be used.

Metals coated with or containing materials that emit toxic fumes should not be heated unless coating is removed from the work surface, the area is well ventilated and, if necessary, while wearing an air-supplied respirator.

Work in a confined space only while it is being ventilated and, if necessary, while wearing an air-supplied respirator.

Gas leaks in a confined space should be avoided. Leaked gas in large quantities can change oxygen concentration dangerously. Do not bring gas cylinders into a confined space.

Leaving confined space, shut OFF gas supply at source to prevent possible accumulation of gases in the space if downstream valves have been accidentally opened or left open. Check to be sure that the space is safe before re-entering it.

Vapors from chlorinated solvents can be decomposed by the heat of the arc (or flame) to form PHOSGENE, a highly toxic gas, and other lung and eye irritating products. The ultraviolet (radiant) energy of the arc can also decompose trichloroethylene and perchloroethylene vapors to form phosgene. **DO NOT WELD** or cut where solvent vapors can be drawn into the welding or cutting atmosphere or where the radiant energy can penetrate

to atmospheres containing even minute amounts of trichloroethylene or perchloroethylene.

### **C. Fire and Explosion Prevention**

Causes of fire and explosion are: combustibles reached by the arc, flame, flying sparks, hot slag or heated material; misuse of compressed gases and cylinders; and short circuits.

BE AWARE THAT flying sparks or falling slag can pass through cracks, along pipes, through windows or doors, and through wall or floor openings, out of sight of the goggled operator. Sparks and slag can fly 35 feet.

To prevent fires and explosion:

Keep equipment clean and operable, free of oil, grease, and (in electrical parts) of metallic particles that can cause short circuits.

If combustibles are in area, do NOT weld or cut. Move the work if practicable, to an area free of combustibles. Avoid paint spray rooms, dip tanks, storage areas, ventilators. If the work cannot be moved, move combustibles at least 35 feet away out of reach of sparks and heat; or protect against ignition with suitable and snug-fitting, fire-resistant covers or shields.

Walls touching combustibles on opposite sides should not be welded on (or cut). Walls, ceilings, and floor near work should be protected by heat-resistant covers or shields.

Fire watcher must be standing by with suitable fire extinguishing equipment during and for some time after welding or cutting if:

- a. appreciable combustibles (including building construction) are within 35 feet
- b. appreciable combustibles are further than 35 feet but can be ignited by sparks
- c. openings (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks
- d. combustibles adjacent to walls, ceilings, roofs, or metal partitions can be ignited by radiant or conducted heat.

Hot work permit should be obtained before operation to ensure supervisor's approval that adequate precautions have been taken.

After work is done, check that area is free of sparks, glowing embers, and flames.

An empty container that held combustibles, or that can produce flammable or toxic vapors when heated, must never be welded on or cut, unless container has first been cleaned as described in AWS Standard A6.0, listed 7 in Standards Index.

This includes: a thorough steam or caustic cleaning (or a solvent or water washing, depending on the combustible's solubility) followed by purging and inerting with nitrogen or carbon dioxide, and using protective equip-

ment as recommended in A6.0. Waterfilling just below working level may substitute for inerting.

A container with unknown contents should be cleaned (see preceding paragraph). Do NOT depend on sense of smell or sight to determine if it is safe to weld or cut.

Hollow castings or containers must be vented before welding or cutting. They can explode.

Explosive atmospheres. Never weld or cut where the air may contain flammable dust, gas, or liquid vapors (such as gasoline).

### **D. Compressed Gas Equipment**

Standard precautions. Comply with precautions in this manual, and those detailed in CGA Standard P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, listed 11 in Standards Index.

#### **1. Pressure Regulators**

Regulator relief valve is designed to protect only the regulator from overpressure; it is not intended to protect any downstream equipment. Provide such protection with one or more relief devices.

Never connect a regulator to a cylinder containing gas other than that for which the regulator was designed.

Remove faulty regulator from service immediately for repair (first close cylinder valve). The following symptoms indicate a faulty regulator:

Leaks-if gas leaks externally.

Excessive Creep-if delivery pressure continues to rise with downstream valve closed.

Faulty Gauge-if gauge pointer does not move off stop pin when pressurized, nor returns to stop pin after pressure release.

Repair. Do NOT attempt to repair. Send faulty regulators for repair to manufacturer's designated repair center, where special techniques and tools are used by trained personnel.

#### **2. Cylinders**

Cylinders must be handled carefully to prevent leaks and damage to their walls, valves, or safety devices:

Avoid electrical circuit contact with cylinders including third rails, electrical wires, or welding circuits. They can produce short circuit arcs that may lead to a serious accident. (See 1-3C.)

ICC or DOT marking must be on each cylinder. It is an assurance of safety when the cylinder is properly handled.

Identifying gas content. Use only cylinders with name of gas marked on them; do not rely on color to identify gas content. Notify supplier if unmarked. NEVER DEFACE or alter name, number, or other markings on a cylinder. It is illegal and hazardous.

Empties: Keep valves closed, replace caps securely; mark MT; keep them separate from FULLS and return promptly.

**Prohibited use.** Never use a cylinder or its contents for other than its intended use, NEVER as a support or roller.

Locate or secure cylinders so they cannot be knocked over.

Passageways and work areas. Keep cylinders clear of areas where they may be struck.

Transporting cylinders. With a crane, use a secure support such as a platform or cradle. Do NOT lift cylinders off the ground by their valves or caps, or by chains, slings, or magnets.

Do NOT expose cylinders to excessive heat, sparks, slag, and flame, etc. that may cause rupture. Do not allow contents to exceed 130°F. Cool with water spray where such exposure exists.

Protect cylinders particularly valves from bumps, falls, falling objects, and weather. Replace caps securely when moving cylinders.

Stuck valve. Do NOT use a hammer or wrench to open a cylinder valve that can not be opened by hand. Notify your supplier.

Mixing gases. Never try to mix any gases in a cylinder.

Never refill any cylinder.

Cylinder fittings should never be modified or exchanged.

### 3. Hose

**Prohibited use.** Never use hose other than that designed for the specified gas. A general hose identification rule is: red for fuel gas, green for oxygen, and black for inert gases.

Use ferrules or clamps designed for the hose (not ordinary wire or other substitute) as a binding to connect hoses to fittings.

No copper tubing splices. Use only standard brass fittings to splice hose.

Avoid long runs to prevent kinks and abuse. Suspend hose off ground to keep it from being run over, stepped on, or otherwise damaged.

Coil excess hose to prevent kinks and tangles.

Protect hose from damage by sharp edges, and by sparks, slag, and open flame.

Examine hose regularly for leaks, wear, and loose connections. Immerse pressured hose in water; bubbles indicate leaks.

Repair leaky or worn hose by cutting area out and splicing (1-2D3). Do NOT tape.

### 4. Proper Connections

Clean cylinder valve outlet of impurities that may clog orifices and damage seats before connecting regulator. Except for hydrogen, crack valve momentarily, pointing

outlet away from people and sources of ignition. Wipe with a clean lintless cloth.

Match regulator to cylinder. Before connecting, check that the regulator label and cylinder marking area, and that the regulator inlet and cylinder outlet match. NEVER CONNECT a regulator designed for a particular gas or gases to a cylinder containing any other gas.

Tighten connections. When assembling threaded connections; clean and smooth seats where necessary. Tighten. If connection leaks, disassemble, clean, and retighten using properly fitting wrench.

Adapters. Use a CGA adapter (available from your supplier) between cylinder and regulator, if one is required. Use two wrenches to tighten adapter marked RIGHT and LEFT HAND threads.

Regulator outlet (or hose) connections may be identified by right hand threads for oxygen and left hand threads (with grooved hex on nut or shank) for fuel gas.

### 5. Pressurizing Steps:

Drain regulator of residual gas through suitable vent before opening cylinder (or manifold valve) by turning adjusting screw in (clockwise). Draining prevents excessive compression heat at high pressure seat by allowing seat to open on pressurization. Leave adjusting screw engaged slightly on single-stage regulators.

Stand to side of regulator while opening cylinder valve.

Open cylinder valve slowly so that regulator pressure increases slowly. When gauge is pressurized (gauge reaches regulator maximum) leave cylinder valve in following position: For oxygen, and inert gases, open fully to seal stem against possible leak. For fuel gas, open to less than one turn to permit quick emergency shutoff.

Use pressure charts (available from your supplier) for safe and efficient, recommended pressure settings on regulators.

Check for leaks on first pressurization and regularly thereafter. Brush with soap solution (capfull of Ivory Liquid\* or equivalent per gallon of water). Bubbles indicate leak. Clean off soapy water after test; dried soap is combustible.

### E. User Responsibilities

Remove leaky or defective equipment from service immediately for repair. See User Responsibility statement in equipment manual.

### F. Leaving Equipment Unattended

Close gas supply at source and drain gas.

### G. Rope Staging-Support

Rope staging-support should not be used for welding or cutting operation; rope may burn.

\*Trademark of Proctor & Gamble.

### 1-3. ARC WELDING

Comply with precautions in 1-1, 1-2, and this section. Arc Welding, properly done, is a safe process, but a careless operator invites trouble. The equipment carries high currents at significant voltages. The arc is very bright and hot. Sparks fly, fumes rise, ultraviolet and infrared energy radiates, weldments are hot, and compressed gases may be used. The wise operator avoids unnecessary risks and protects himself and others from accidents. Precautions are described here and in standards referenced in index.

#### A. Burn Protection

Comply with precautions in 1-2.

The welding arc is intense and visibly bright. Its radiation can damage eyes, penetrate lightweight clothing, reflect from light-colored surfaces, and burn the skin and eyes. Skin burns resemble acute sunburn, those from gas-shielded arcs are more severe and painful. **DON'T GET BURNED; COMPLY WITH PRECAUTIONS.**

##### 1. Protective Clothing

Wear long-sleeve clothing (particularly for gas-shielded arc) in addition to gloves, hat, and shoes (1-2A). As necessary, use additional protective clothing such as leather jacket or sleeves, flame-proof apron, and fire-resistant leggings. Avoid outer garments of untreated cotton.

Bare skin protection. Wear dark, substantial clothing. Button collar to protect chest and neck and button pockets to prevent entry of sparks.

##### 2. Eye and Head Protection

Protect eyes from exposure to arc. **NEVER** look at an electric arc without protection.

Welding helmet or shield containing a filter plate shade no. 12 or denser must be used when welding. Place over face before striking arc.

Protect filter plate with a clear cover plate.

Cracked or broken helmet or shield should **NOT** be worn; radiation can pass through to cause burns.

Cracked, broken, or loose filter plates must be replaced **IMMEDIATELY**. Replace clear cover plate when broken, pitted, or spattered.

Flash goggles with side shields **MUST** be worn under the helmet to give some protection to the eyes should the helmet not be lowered over the face before an arc is struck. Looking at an arc momentarily with unprotected eyes (particularly a high intensity gas-shielded arc) can cause a retinal burn that may leave a permanent dark area in the field of vision.

##### 3. Protection of Nearby Personnel

Enclosed welding area. For production welding, a separate room or enclosed bay is best. In open areas, surround the operation with low-reflective, non-combustible screens or panels. Allow for free air circulation, particularly at floor level.

Viewing the weld. Provide face shields for all persons who will be looking directly at the weld.

Others working in area. See that all persons are wearing flash goggles.

Before starting to weld, make sure that screen flaps or bay doors are closed.

#### B. Toxic Fume Prevention

Comply with precautions in 1-2B.

Generator engine exhaust must be vented to the outside air. Carbon monoxide can kill.

#### C. Fire and Explosion Prevention

Comply with precautions in 1-2C.

Equipment's rated capacity. Do not overload arc welding equipment. It may overheat cables and cause a fire.

Loose cable connections may overheat or flash and cause a fire.

Never strike an arc on a cylinder or other pressure vessel. It creates a brittle area that can cause a violent rupture or lead to such a rupture under rough handling.

#### D. Compressed Gas Equipment

Comply with precautions in 1-2D.

#### E. Shock Prevention

Exposed hot conductors or other bare metal in the welding circuit, or in ungrounded, electrically-HOT equipment can fatally shock a person whose body becomes a conductor. **DO NOT STAND, SIT, LIE, LEAN ON, OR TOUCH** a wet surface when welding, without suitable protection.

To protect against shock:

Wear dry insulating gloves and body protection. Keep body and clothing dry. Never work in damp area without adequate insulation against electrical shock. Stay on a dry duckboard, or rubber mat when dampness or sweat can not be avoided. Sweat, sea water, or moisture between body and an electrically HOT part or grounded metal reduces the electrical resistance, and could enable dangerous and possibly lethal currents to flow through the body.

A voltage will exist between the electrode and any conducting object in the work circuit. Examples of conducting objects include, but are not limited to, buildings, electrical tools, work benches, welding power source cases, workpieces, etc. **Never touch the electrode and any metal object unless the welding power source is off.**

##### 1. Grounding the Equipment

Arc welding equipment must be grounded according to the National Electrical Code, and the work must be grounded according to ANSI Z49.1 "Safety In Welding And Cutting."

When installing, connect the frames of each unit such as welding power source, control, work table, and water circulator to the building ground. Conductors must be adequate to carry ground currents safely. Equipment made

electrically HOT by stray current may shock, possibly fatally. Do NOT GROUND to electrical conduit, or to a pipe carrying ANY gas or flammable liquid such as oil or fuel.

**Three-phase connection.** Check phase requirements of equipment before installing. If only 3-phase power is available, connect single-phase equipment to only two wires of the 3-phase line. Do NOT connect the equipment ground lead to the third (live) wire, or the equipment will become electrically HOT—a dangerous condition that can shock, possibly fatally.

Before welding, check ground for continuity. Be sure conductors are touching bare metal of equipment frames at connections.

If a line cord with a ground lead is provided with the equipment for connection to a switchbox, connect the ground lead to the grounded switchbox. If a three-prong plug is added for connection to a grounded mating receptacle, the ground lead must be connected to the ground prong only. If the line cord comes with a three-prong plug, connect to a grounded mating receptacle. Never remove the ground prong from a plug, or use a plug with a broken off ground prong.

## 2. Electrode Holders

Fully insulated electrode holders should be used. Do NOT use holders with protruding screws.

## 3. Connectors

Fully insulated lock-type connectors should be used to join welding cable lengths.

## 4. Cables

Frequently inspect cables for wear, cracks and damage. IMMEDIATELY REPLACE those with excessively worn or damaged insulation to avoid possibly-lethal shock from bared cable. Cables with damaged areas may be taped to give resistance equivalent to original cable.

Keep cable dry, free of oil and grease, and protected from hot metal and sparks.

## 5. Terminals And Other Exposed Parts

Terminals and other exposed parts of electrical units should have insulating covers secured before operation.

## 6. Electrode

### a. Equipment with output on/off control (contactor)

Welding power sources for use with the gas metal arc welding (GMAW), gas tungsten arc welding (GTAW) and similar processes normally are equipped with devices that permit on-off control of the welding power output. When so equipped the electrode wire becomes electrically HOT when the power source switch is ON and the welding gun switch is closed. Never touch the electrode wire or any conducting object in contact with the electrode circuit unless the welding power source is off.

### b. Equipment without output on/off control (no contactor)

Welding power sources used with shielded metal arc welding (SMAW) and similar processes may not be equipped with welding power output on-off control devices. With such equipment the electrode is electrically HOT when the power switch is turned ON. Never touch the electrode unless the welding power source is off.

## 7. Safety Devices

Safety devices such as interlocks and circuit breakers should not be disconnected or shunted out.

Before installation, inspection, or service, of equipment, shut OFF all power and remove line fuses (or lock or red-tag switches) to prevent accidental turning ON of power. Disconnect all cables from welding power source, and pull all 115 volts line-cord plugs.

Do not open power circuit or change polarity while welding. If, in an emergency, it must be disconnected, guard against shock burns, or flash from switch arcing.

Leaving equipment unattended. Always shut OFF and disconnect all power to equipment.

Power disconnect switch must be available near the welding power source.

## F. Protection For Wearers of Electronic Life Support Devices (Pacemakers)

Magnetic fields from high currents can affect pacemaker operation. Persons wearing electronic life support equipment (pacemaker) should consult with their doctor before going near arc welding, gouging, or spot welding operations.

## 1-4. STANDARDS BOOKLET INDEX

For more information, refer to the following standards or their latest revisions and comply as applicable:

1. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126.
2. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
3. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES

obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126.
8. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING, AND ALLIED PROCESSES obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
9. NFPA Standard 70, NATIONAL ELECTRICAL CODE obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS obtainable

from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.

12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.
13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103.
14. American Welding Society Standard AWSF4.1, RECOMMENDED SAFE PRACTICES FOR THE PREPARATION FOR WELDING AND CUTTING OF CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126.
15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

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## SECTION 2 – SAFETY PRECAUTIONS AND SIGNAL WORDS

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### 2-1. GENERAL INFORMATION AND SAFETY

#### A . General

Information presented in this manual and on various labels, tags, and plates on the unit pertains to equipment design, installation, operation, maintenance, and troubleshooting which should be read, understood, and followed for the safe and effective use of this equipment.

The nameplate of this unit uses international symbols for labeling the front panel controls. The symbols also appear at the appropriate section in the text.

#### B . Safety

The installation, operation, maintenance, and troubleshooting of arc welding equipment requires practices and procedures which ensure personal safety and the safety of others. Therefore, this equipment is to be installed, operated, and maintained only by qualified persons in accordance with this manual and all applicable codes such as, but not limited to, those listed at the end of Section 1 – Safety Rules For Operation Of Arc Welding Power Source.

### 2-2. SAFETY ALERT SYMBOL AND SIGNAL WORDS

The following safety alert symbol and signal words are used throughout this manual to call attention to and identify different levels of hazard and special instructions.



This safety alert symbol is used with the signal words **WARNING** and **CAUTION** to call attention to the safety statements.



**WARNING** statements identify procedures or practices which must be followed to avoid serious personal injury or loss of life.



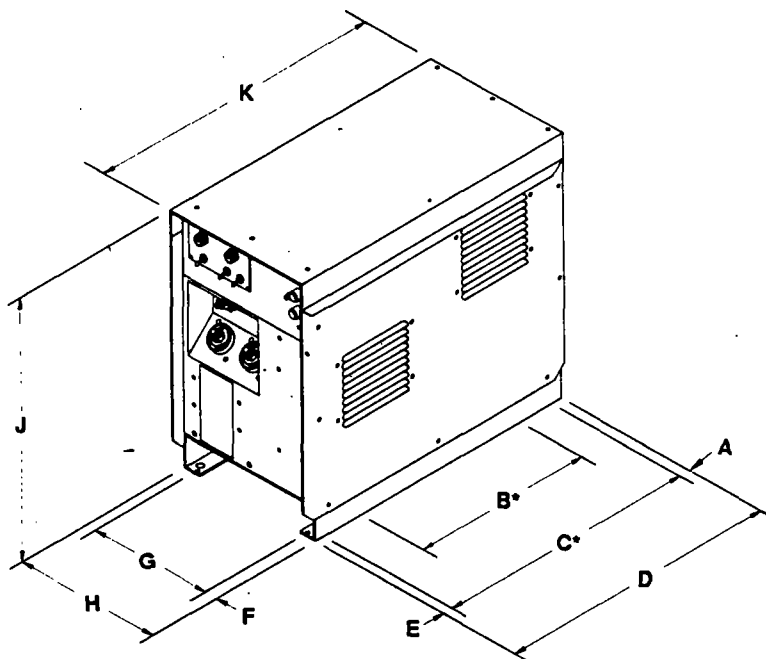
**CAUTION** statements identify procedures or practices which must be followed to avoid minor personal injury or damage to this equipment.

**IMPORTANT** statements identify special instructions necessary for the most efficient operation of this equipment.

## SECTION 3 – SPECIFICATIONS

**Table 3-1. Specifications**

| Input Power  | Rated Output At 100% Duty Cycle | Voltage-Range In CV Mode | Amperage Range in CC Mode | Max. Open-Circuit Voltage In CC Mode | Input At Rated Load Output 50/60 Hz |      |      |      | Weight           |                  |
|--------------|---------------------------------|--------------------------|---------------------------|--------------------------------------|-------------------------------------|------|------|------|------------------|------------------|
|              |                                 |                          |                           |                                      | Amperes At                          |      | kva  |      |                  |                  |
|              |                                 |                          |                           |                                      | 230V                                | 460V |      | Net  | Ship             |                  |
| Three-Phase  | 350 Amperes At 34 Volts DC      | 10-35 Volts              | 5-350 Amperes             | 70 Volts DC                          | 42                                  | 21   | 16.7 | 13.8 | 150 lbs. (68 kg) | 164 lbs. (74 kg) |
| Single-Phase | 275 Amperes 31 Volts DC         |                          |                           |                                      | 60                                  | 30   | 14.3 | 10   |                  |                  |



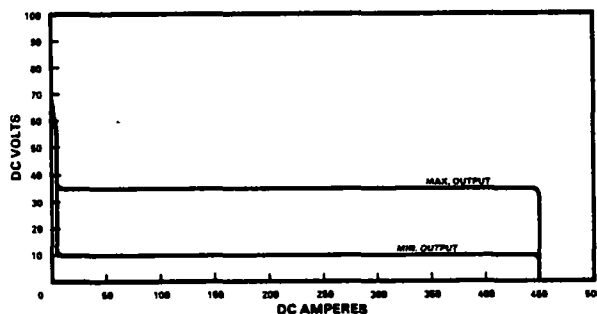
| Base Mounting Hole Layout |          |             |
|---------------------------|----------|-------------|
|                           | Inches   | Millimeters |
| A                         | 1-9/16   | 39.7        |
| B*                        | 13       | 330.2       |
| C*                        | 23       | 584.2       |
| D                         | 25-13/32 | 645.3       |
| E                         | 25/32    | 19.8        |
| F                         | 3/4      | 19.0        |
| G                         | 11-1/2   | 292.1       |
| H                         | 13       | 330.2       |
| J                         | 23       | 584.2       |
| K                         | 26-1/4   | 668.8       |

\*B holes are 3/8 in. (9.5 mm) Dia. (4 holes)  
 \*C holes are 14/32 in. (13.5 mm) Dia. (4 holes)

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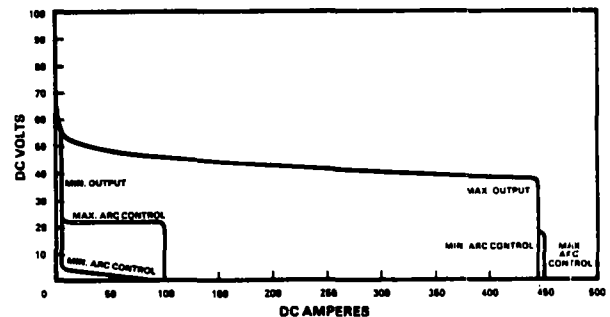
**Figure 3-1. Overall Dimensions And Base Mounting Hole Layout**

**Chart 3-1. Volt-Ampere Curves**



B-099 012

**Volt-Ampere Curves For CV Mode  
(With 3-Phase, 60 Hz Input)**



B-099 013

**Volt-Ampere Curves For CC Mode  
(With 3-Phase, 60 Hz Input)**

### 3-1. VOLT-AMPERE CURVES (Chart 3-1)

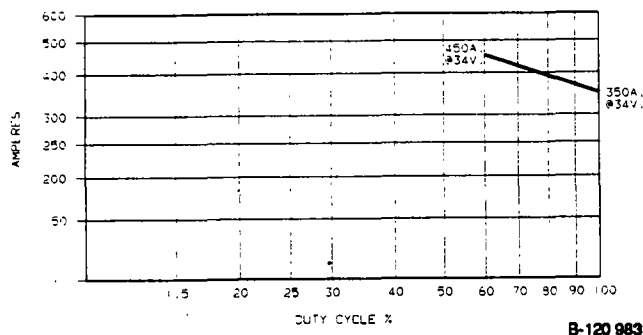


The volt-ampere curves show the voltage and amperage output capabilities of the welding power source. Curves of other settings fall between the curves shown.

With the use of the volt-ampere curves, it is possible to determine the weld amperage at any particular load voltage.

### 3-2. DUTY CYCLE (Chart 3-2)

Chart 3-2. Duty Cycle



The duty cycle is the percentage of a ten minute period that a welding power source can be operated at a given output without overheating and damaging the unit. This welding power source is rated at 100% duty cycle. The

unit can be operated at rated load continuously. If the welding amperes increase beyond rated output, the duty cycle decreases.

Refer to the Duty Cycle chart (Chart 3-2) to determine the output of the welding power source at various duty cycles.



**CAUTION: EXCEEDING DUTY CYCLE RATINGS will damage the welding power source.**

- Do not exceed indicated duty cycles.

### 3-3. DESCRIPTION

This unit is a three-phase, or single-phase if derated, dc, arc welding power source having constant voltage (CV) and constant current (CC) output characteristics for multi-process capability. The unit produces dc weld output and is designed for use with Shielded Metal Arc (SMAW), Gas Metal Arc (GMAW), Gas Tungsten Arc (GTAW), Flux Cored Arc (FCAW), Submerged Arc (SAW), and Air Carbon Arc (ACA) cutting and gouging welding processes.

This unit is capable of both pulsed and nonpulsed operation. The welding power source compensates for line voltage fluctuation of  $\pm 10\%$ .

The solid-state, electronic components of this unit are located in sealed areas unexposed to airflow and associated contaminants. The fan motors cool only the heat sinks and main transformer.

## SECTION 4 – INSTALLATION OR RELOCATION

### 4-1. SITE SELECTION

Select an installation site which provides the following:

1. Correct input power supply (see unit nameplate)
2. Shielding gas supply (if applicable)
3. Water supply (if applicable)
4. Adequate ventilation and fresh air supply
5. No flammables
6. A clean and dry area
7. Proper temperature that avoids extremes of heat or cold
8. Proper airflow around unit
9. Adequate space for removing top cover and outer panels for installation, maintenance, and repair functions.

Base mounting holes provide the capability to install and secure the unit on a running gear or in a permanent location. Figure 3-1 gives overall dimensions and base mounting hole layout.



**WARNING: FIRE OR EXPLOSION can result from placing unit on or over combustible surfaces; RESTRICTED AIRFLOW can cause overheating and possible damage to internal parts.**

- Do not locate unit over combustible surfaces.
- Maintain at least 6 inches (152 mm) of unrestricted space on right side of unit, and keep underside free of obstructions.
- Do not place any filtering device over the intake air passages that provide airflow for cooling this unit.

Warranty is void if any type of filtering device is used at intake air passages.

## 4-2. TRANSPORTING METHODS

This welding power source has space underneath it for lift forks.



### **WARNING: ELECTRIC SHOCK can kill.**

- Do not touch live electrical parts.
- Disconnect input power conductors from deenergized supply line **BEFORE** moving welding power source.

**FALLING EQUIPMENT can cause serious personal injury and equipment damage.**

- Use equipment of adequate capacity to lift the unit.
- If lifting or moving this unit with lift forks under the base, be sure that lift forks are long enough to extend beyond opposite side of the base.

Using lift forks too short can damage internal parts if tips of the lift forks penetrate the unit base, or may cause personal injury and/or equipment damage if unit falls off the lift forks.

## 4-3. WELD OUTPUT CONNECTIONS (Figure 5-1)



### **RATED OUTPUT**

To obtain full rated output from this unit, it is necessary to select, prepare, and install proper weld cables. Failure to comply in any of these areas may result in unsatisfactory welding performance.

### **A. Weld Cable Selection**

Use the following guidelines to select weld cables:

1. Use the shortest possible cables, and place cables close together. Excessive cable lengths may reduce output or cause unit overload due to added resistance.

2. Use weld cable with an insulation voltage rating equal to or greater than the maximum open-circuit voltage (ocv) of the welding power source (see Table 3-1 for unit maximum ocv rating).
3. Select welding cable size according to maximum weld output and total length of connecting cables in weld circuit. For example, if a 25 foot (7.5 m) wire feeder or electrode holder cable is used with a 25 foot (7.5 m) work cable, select the cable size recommended in Table 4-1 for 50 feet (15 m).
4. Do not use damaged or frayed cables.

### **B. Weld Cable Preparation**

1. Install terminal lugs of adequate amperage capacity and correct stud size onto cables that connect to the work clamp, wire feeder or electrode holder, and weld output terminals.
2. If installing an electrode holder, follow manufacturer's installation instructions. Always use an insulated electrode holder to ensure operator safety.
3. Install work clamp onto cable.

### **C. Weld Cable Connections To Welding Power Source (Figure 5-1)**

**NEGATIVE**

**POSITIVE**



### **WARNING: ELECTRIC SHOCK can kill.**

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting or installing.

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

**Table 4-1. Weld Cable Size**

| Welding Amperes | Total Cable (Copper) Length In Weld Circuit Not Exceeding* |                            |                         |                   |                   |                   |                    |                    |
|-----------------|------------------------------------------------------------|----------------------------|-------------------------|-------------------|-------------------|-------------------|--------------------|--------------------|
|                 | 100 ft. Or Less<br>(30 m)                                  |                            | 150 ft.<br>(45 m)       | 200 ft.<br>(60 m) | 250 ft.<br>(70 m) | 300 ft.<br>(90 m) | 350 ft.<br>(105 m) | 400 ft.<br>(120 m) |
|                 | 10 To 60%<br>Duty Cycle                                    | 60 Thru 100%<br>Duty Cycle | 10 Thru 100% Duty Cycle |                   |                   |                   |                    |                    |
| 100             | 4                                                          | 4                          | 4                       | 3                 | 2                 | 1                 | 1/0                | 1/0                |
| 150             | 3                                                          | 3                          | 2                       | 1                 | 1/0               | 2/0               | 3/0                | 3/0                |
| 200             | 3                                                          | 2                          | 1                       | 1/0               | 2/0               | 3/0               | 4/0                | 4/0                |
| 250             | 2                                                          | 1                          | 1/0                     | 2/0               | 3/0               | 4/0               | 2-2/0              | 2-2/0              |
| 300             | 1                                                          | 1/0                        | 2/0                     | 3/0               | 4/0               | 2-2/0             | 2-3/0              | 2-3/0              |
| 350             | 1/0                                                        | 2/0                        | 3/0                     | 4/0               | 2-2/0             | 2-3/0             | 2-3/0              | 2-4/0              |
| 400             | 1/0                                                        | 2/0                        | 3/0                     | 4/0               | 2-2/0             | 2-3/0             | 2-4/0              | 2-4/0              |
| 500             | 2/0                                                        | 3/0                        | 4/0                     | 2-2/0             | 2-3/0             | 2-4/0             | 3-3/0              | 3-3/0              |
| 600             | 3/0                                                        | 4/0                        | 2-2/0                   | 2-3/0             | 2-4/0             | 3-3/0             | 3-4/0              | 3-4/0              |

\*Weld cable size (AWG) is based on either a 4 volts or less drop or a current density of more than 300 circular mils per ampere.

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1. For Shielded Metal Arc Welding (SMAW) (Electrode Positive/Reverse Polarity)
  - a. Connect end of electrode holder cable to POSITIVE (+) weld output terminal.
  - b. Connect one end of work cable to NEGATIVE (–) weld output terminal and remaining end to workpiece.

**IMPORTANT:** For Electrode Negative/Straight Polarity connections, reverse cable connections to weld output terminals; electrode becomes negative.

2. For Gas Metal Arc Welding (GMAW), Flux Cored Arc Welding (FCAW), and Submerged Arc Welding (SAW) (Electrode Positive/Reverse Polarity)
  - a. Connect one end of weld cable to POSITIVE (+) weld output terminal and remaining end to terminal on drive housing of wire feeder (see wire feeder Owner's Manual for location).
  - b. Connect one end of work cable to NEGATIVE (–) weld output terminal and remaining end to workpiece.

**IMPORTANT:** For Electrode Negative/Straight Polarity connections, reverse cable connections to weld output terminals; electrode becomes negative.

3. For Gas Tungsten Arc Welding (GTAW) (Electrode Negative/Straight Polarity)
  - a. Connect torch cable or connector to NEGATIVE (–) weld output terminal.
  - b. Connect one end of work cable to POSITIVE (+) weld output terminal and remaining end to workpiece.

**IMPORTANT:** For Electrode Positive/Reverse Polarity connections, reverse cable connections to weld output terminals; electrode (torch) becomes positive.

4. For Air Carbon Arc Cutting And Gouging (ACA) (Electrode Positive/Reverse Polarity)
  - a. Connect torch cable to POSITIVE (+) weld output terminal.
  - b. Connect one end of work cable to NEGATIVE (–) weld output terminal and remaining end to workpiece.

**IMPORTANT:** For Electrode Negative/Straight Polarity connections, reverse cable connections to weld output terminals; electrode (torch) becomes negative.

#### 4-4. ELECTRICAL INPUT CONNECTIONS



**WARNING: ELECTRIC SHOCK can kill.**

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting or installing.

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

#### A. Electrical Input Requirements

Operate the welding power source from a three-phase, or single-phase if derated, 50/60 Hertz, ac power supply. The input voltage must match one of the electrical input voltages shown on the input data label on the unit nameplate. Contact the local electric utility for information about the type of electrical service available, how proper connections should be made, and inspection required.

#### B. Jumper Link Installation (Figure 4-1)



**WARNING: Read and follow safety information at beginning of entire Section 4-4 before proceeding.**

Jumper links are used to allow the equipment to operate from different line voltages. The jumper links may be in a bag attached to the input terminal board and terminal strip 1T or installed for the highest voltage shown on the input voltage label.

1. Remove top cover and left side panel.
2. Compare position of jumper links on the input terminal board and terminal strip 1T to the voltage link arrangement shown on input voltage label.



**CAUTION: INCORRECT INPUT VOLTAGE JUMPER LINK PLACEMENT can damage unit.**

- Position jumper links as shown on the input voltage label (see Figure 4-1).
- Store unused jumper links across linked terminals.

3. Install jumper links onto the input terminal board and terminal strip 1T to match the available input line voltage.
4. Reinstall and secure left side panel and top cover onto unit.

#### C. Welding Power Source Input Power Connections (Figure 4-1)



**WARNING: ELECTRIC SHOCK can kill.**

- Do not touch live electrical parts.
- Install a fusible line disconnect switch in the input circuit to the welding power source.
- Connect input conductors to the welding power source before connecting to single-phase or three-phase input power.
- Read and follow safety information at beginning of entire Section 4-4 before proceeding.

The line disconnect switch provides a safe and convenient means to completely remove all electrical power from the welding power source whenever it is necessary to inspect or service the unit.

1. Use Table 4-2 as a guide to select input conductors for the installation. The input conductors should be covered with an insulating material that complies with national, state, and local electrical codes.
2. Install terminal lugs of adequate amperage capacity and correct stud size onto the input and ground conductors.



**WARNING: ELECTRIC SHOCK can kill.**

- Do not touch live electrical parts.
- Do not connect an input conductor to the ground terminal in the unit.
- Do not connect the ground conductor to an input line terminal.

Incorrect input connections can result in an electrically energized welding power source chassis. The ground terminal is connected to the welding power source chassis and is for grounding purposes only.

3. Remove cover plate from rear panel.
4. Obtain and install a standard conduit strain relief connector into access hole in cover plate.
5. Insert conductors through strain relief installed in Step 4. Route conductors to input terminals.
6. For three-phase input supply: Connect input conductors to line terminals L1, L2, and L3.  
For single-phase input supply: Connect input conductors to the top L1 and bottom L3 terminals.
7. Connect the ground conductor to the ground terminal (see Figure 4-1).

8. Reinstall cover plate onto rear panel, and secure input cable in strain relief connector.
9. Connect remaining end of ground conductor to a suitable ground. Use a grounding method that complies with all applicable electrical codes.
10. Connect remaining ends of input conductors to a deenergized line disconnect switch.
11. Use Table 4-2 as a guide to select line fuses for the disconnect switch. Obtain and install proper fuses.

**Table 4-2. Input Conductor And Fuse Size\***

| Input Power  | Input Voltage | Input Conductor Size (AWG) | Ground Conductor Size (AWG) | Fuse Size In Amperes |
|--------------|---------------|----------------------------|-----------------------------|----------------------|
| Three-Phase  | 230           | 8                          | 10                          | 60                   |
|              | 460           | 10                         | 10                          | 30                   |
| Single-Phase | 230           | 6                          | 10                          | 60                   |
|              | 460           | 8                          | 10                          | 40                   |

\*Conductor size is based on the 1987 Edition of the National Electrical Code (NEC) specifications for allowable ampacities of insulated copper conductors, having a temperature rating of 167°F (75°C), with not more than three single current-carrying conductors in a raceway (Article 310 of NEC). (The ground conductor is not counted as a current-carrying conductor.)

\*Fuse size is based on not more than 200 percent of the rated input amperage of the welding power source (Article 630 of NEC).

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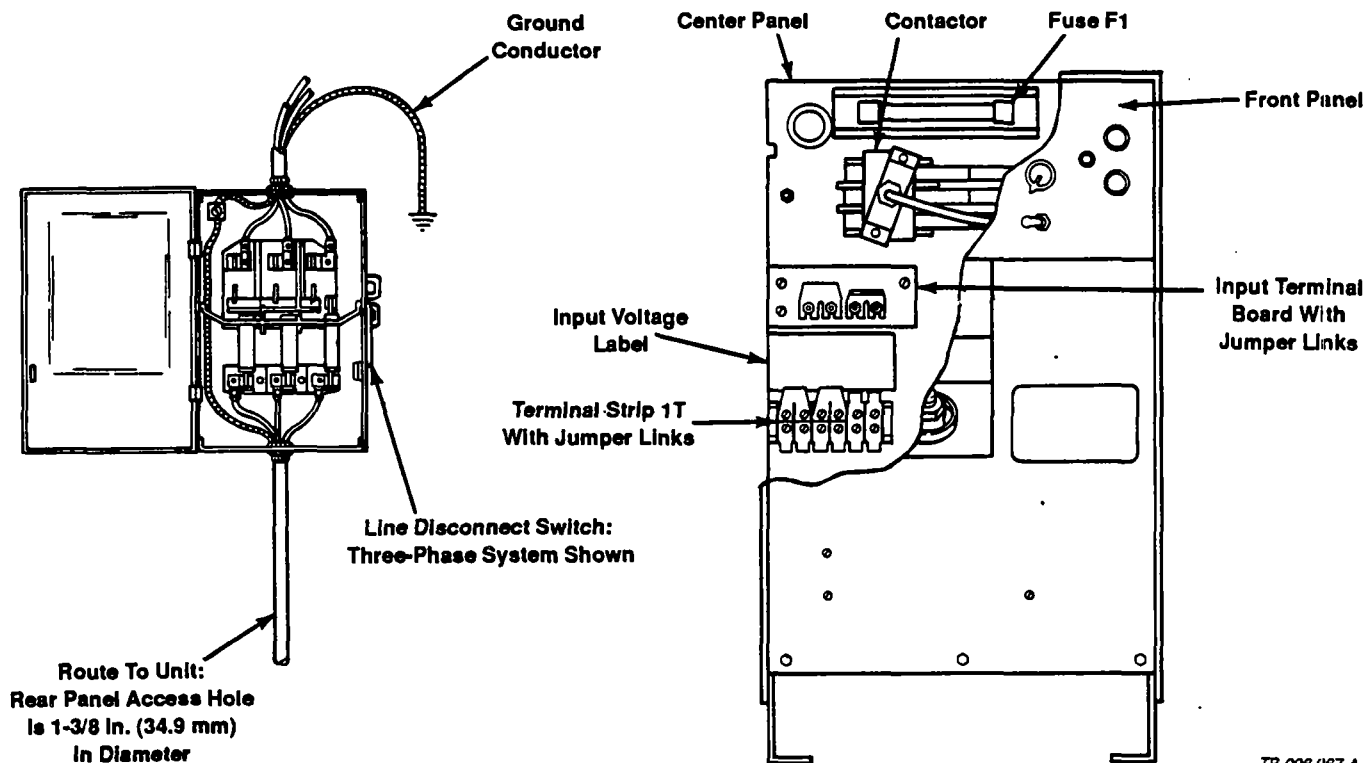
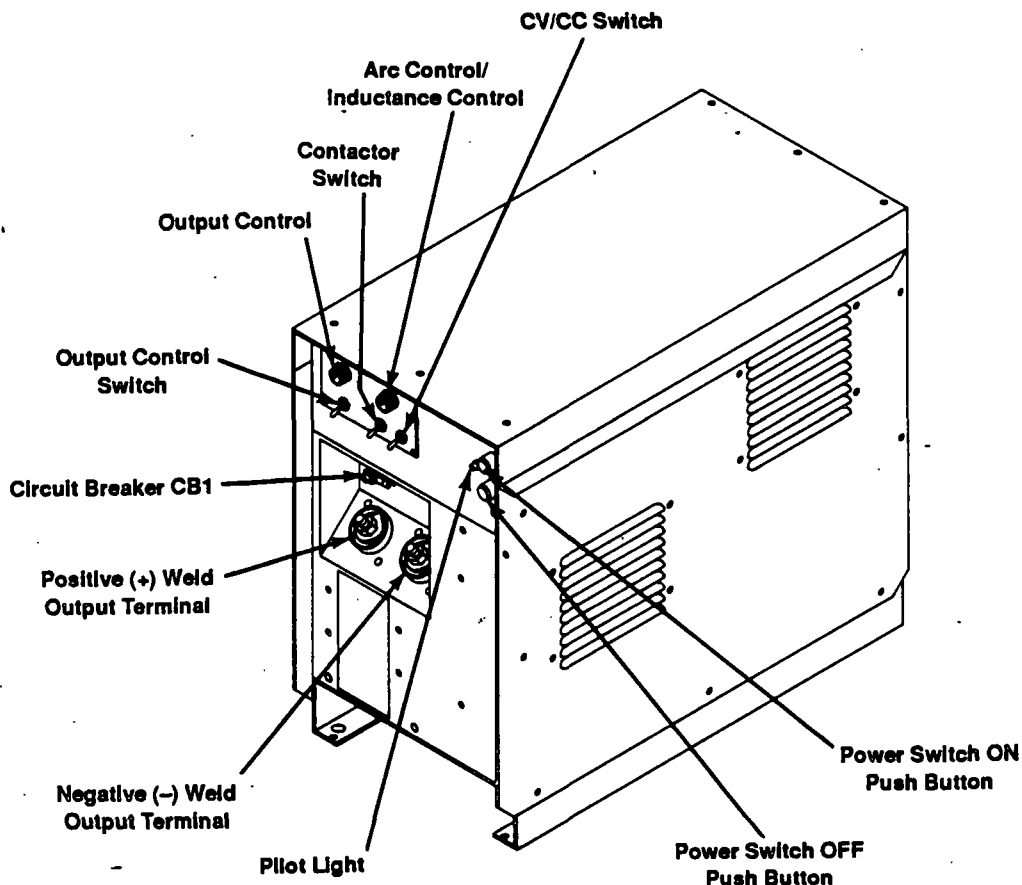


**Figure 4-1. Component Locations And Input Conductor Connections**

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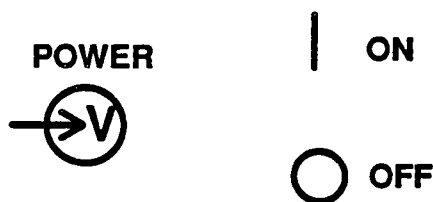
## SECTION 5 – OPERATOR CONTROLS



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Figure 5-1. Front Panel View

### 5-1. POWER SWITCH (Figure 5-1)



Depressing the POWER switch ON push button energizes the welding power source. Depressing the POWER switch OFF push button shuts down the welding power source.

**IMPORTANT:** After any interruption of input power, the POWER switch ON push button must be depressed to reenergize the welding power source.

### 5-2. PILOT LIGHT (Figure 5-1)

The pilot light comes on when the POWER switch ON button is depressed and indicates that the unit is energized.

### 5-3. OUTPUT CONTROL (Figure 5-1)

The OUTPUT control provides a means of selecting the desired output within the entire range of the welding power source. The control adjusts the voltage level (V) in the CV mode and the amperage level (A) in the CC mode from minimum to maximum of power source capability. Rotating the control clockwise increases weld output, and rotating the control counterclockwise decreases weld output.

**IMPORTANT:** The OUTPUT control may be adjusted while welding.

### 5-4. ARC CONTROL/INDUCTANCE CONTROL (Figure 5-1)

The ARC CONTROL/INDUCTANCE control functions as an arc control in the constant current (CC) mode and as an inductance control in the constant voltage (CV) mode.

**IMPORTANT:** The ARC CONTROL/INDUCTANCE control may be adjusted while welding. The control should be set at 0 (zero) for Gas Tungsten Arc Welding (GTAW).

### A. Arc Control (Used In CC Mode For Shielded Metal Arc Welding (SMAW) And Air Carbon Arc Cutting And Gouging (ACA) Processes)

**IMPORTANT:** The maximum ARC CONTROL current available is 150 amperes above the ampere value selected on the OUTPUT control. However, unit output, including ARC CONTROL amperes, cannot exceed the rated output of the welding power source. (See volt-ampere curves for CC mode.)

The ARC CONTROL provides variable selection of short-circuit current to suit individual welding conditions. Rotating this control clockwise causes the current to increase as the short-circuit condition is approached.

When the control is set at 100, the short-circuit current is higher (up to 150 amperes) than normal welding current. (See volt-ampere curve for CC mode and IMPORTANT block at beginning of this Subsection.) The increased current enables arc starting in out-of-position welds, and it provides the momentary overcurrents necessary for certain types of electrodes.

When the control is set at 0 (zero), short-circuit current is the same as the welding current.

When the control is set at 50, short-circuit current is approximately half that of the 100 position, but still higher than normal welding current. The 50 position provides a moderate current increase necessary for arc starting certain applications and types of electrodes.

Select a setting best suited for the application and type of electrode.

### B. Inductance Control (Used For Constant Voltage (CV) Operations Only)

Rotating this control clockwise electronically increases inductance. As the level of inductance increases, the rate of current change or speed of response slows down. The slower response time produces a softer arc, more fluid welding puddle, and flatter, smoother bead.

The 0 (zero) setting gives minimum inductance; for example, a stiff, fast-responding arc, and a small, fast-freezing puddle. The 100 setting gives maximum inductance characteristics; for example, a soft, slow-responding, low spatter arc, and high weld puddle fluidity.

Select a setting best suited for the application.

### 5-5. CONTACTOR SWITCH (Figure 5-1)



#### **WARNING: ELECTRIC SHOCK can kill.**

- Do not touch live electrical parts.
- Do not touch the weld output terminals or any metal parts of the welding circuit when the contactor is energized.

If CONTACTOR switch S1 is in the ON position and Output Control switch (PANEL/REMOTE) S3 is in the PANEL position, open-circuit voltage is present at the output terminals whenever the welding power source is energized.



- Do not touch gun wire and work clamp at the same time.
- Place CONTACTOR switch in OFF/REMOTE position when using wire feeder or remote control device to control contactor.

If CONTACTOR switch is in ON position and wire feeder or remote control device is connected to terminal strip 10T, weld output (ocv) will be present whenever the welding power source is energized.

**IMPORTANT:** Although the term CONTACTOR is used on the nameplate, the output is not switched on or off by a physical output contactor; rather, the output is controlled by relay action and solid-state components on circuit boards.

When the CONTACTOR switch is in the ON position, open-circuit voltage (ocv) is present at the weld output terminals whenever the welding power source is energized. When the switch is in the OFF/REMOTE position, no voltage is available at the output terminals -- ocv goes to 0 (zero) volts.

If a wire feeder or remote control device is controlling the contactor, place the CONTACTOR switch in the OFF/REMOTE position. Open-circuit voltage will be present at the weld output terminals whenever the gun trigger or remote control device is closed.

The CONTACTOR switch is normally placed in the OFF/REMOTE position with the Gas Tungsten Arc Welding (GTAW) process and all wire feeding processes -- Gas Metal Arc Welding (GMAW), Flux Cored Arc Welding (FCAW), and Submerged Arc Welding (SAW). The switch is normally placed in the ON position for the Shielded Metal Arc Welding (SMAW) and the Air Carbon Arc (ACA) cutting and gouging processes.

### 5-6. OUTPUT CONTROL SWITCH (Figure 5-1)



#### **WARNING: ELECTRIC SHOCK can kill.**

- Do not touch live electrical parts.
- Do not touch the weld output terminals or any metal parts of the welding circuit when the contactor is energized.

If the CONTACTOR switch S1 is in the ON position and Output Control switch (PANEL/REMOTE) is in the PANEL position, open-circuit voltage is present at the output terminals whenever the welding power source is energized.

- Do not touch gun wire and work clamp at the same time.

If remote contactor control is desired, make proper connections to terminal strip 10T, and place the Output Control switch in the REMOTE position. Open-circuit voltage (ocv) will be present at the weld output terminals whenever the remote control device is closed.

If remote contactor control is not desired, place the Output Control switch in the PANEL position. Open-circuit voltage (ocv) will be present at the output terminals whenever the welding power source is energized.

## 5-7. CV/CC SWITCH (Figure 5-1)

The CV/CC switch provides a means of selecting weld output characteristics for the desired process. When the switch is in the CV (constant voltage) position, the unit provides a constant voltage output specifically designed for wire feeding applications -- Gas Metal Arc Welding

(GMAW), Flux Cored Arc Welding (FCAW), and Shielded Metal Arc Welding (SAW). When the switch is in the CC (constant current) position, the unit provides a constant current output specifically designed for Shielded Metal Arc Welding (SMAW) and Gas Tungsten Arc Welding (GTAW). The CC position is also used for the Air Carbon Arc (ACA) cutting and gouging process.

## SECTION 6 – SEQUENCE OF OPERATION



**WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause serious injury; IMPROPER AIRFLOW AND EXPOSURE TO ENVIRONMENT can damage internal parts.**

- *Do not touch live electrical parts.*
- *Keep all covers and panels in place while operating.*

Warranty is void if the welding power source is operated with any portion of the outer enclosure removed.

**ARC RAYS, SPARKS, AND HOT SURFACES can burn eyes and skin; NOISE can damage hearing.**

- *Wear correct eye, ear, and body protection.*
- FUMES AND GASES can seriously harm your health.**

- *Keep your head out of the fumes.*
- *Ventilate to keep from breathing fumes and gases.*
- *If ventilation is inadequate, use approved breathing device.*

**WELDING WIRE can cause puncture wounds.**

- *Do not point gun toward any part of the body, any conductive surface, or other personnel.*

**HOT METAL, SPATTER, AND SLAG can cause fire and burns.**

- *Watch for fire.*
- *Keep a fire extinguisher nearby, and know how to use it.*
- *Do not use near flammable material.*
- *Allow work and equipment to cool before handling.*

**MAGNETIC FIELDS FROM HIGH CURRENTS can affect pacemaker operation.**

- *Wearers should consult their doctor before going near arc welding, gouging, or spot welding operations.*

See Section 1 - Safety Rules For Operation Of Arc Welding Power Source for basic welding safety information.

### 6-1. GAS METAL ARC (GMAW) AND FLUX CORED ARC WELDING (FCAW)



**WARNING: Read and follow safety information at beginning of entire Section 6 before proceeding.**

1. Install and connect unit according to Section 4.

2. Install and prepare wire feeder according to its Owner's Manual.
3. Place the CONTACTOR switch in the OFF/REMOTE position.
4. Place the CV/CC switch in the CV position.
5. Place the applicable Output Control switch in the desired position (see Section 5-6).
6. Rotate the applicable OUTPUT Control (panel or remote) to the desired position (see Section 5-3).
7. Rotate the INDUCTANCE control to the desired position (see Section 5-4B).
8. Wear dry insulating gloves and clothing, and wear welding helmet with proper filter lens according to ANSI Z49.1.
9. Prepare for welding as follows:
  - a. Connect work clamp to clean, bare metal at workpiece.
  - b. Select and obtain proper welding wire, and thread as instructed in wire feeder Owner's Manual.
10. Turn on shielding gas supply if applicable.
11. Press the POWER switch ON button.
12. Begin welding.

### 6-2. TUNGSTEN ARC WELDING (GTAW)



**WARNING: Read and follow safety information at beginning of entire Section 6 before proceeding.**

1. Install and connect unit according to Section 4.
2. Install and connect the High-Frequency unit according to its Owner's manual if applicable. Scratch start Gas Tungsten-Arc Welding does not require the use of external high frequency.
3. Place the CONTACTOR switch in the OFF/REMOTE position.
4. Place the CV/CC switch in the CC position.
5. Place the Output Control switch in the desired position (see Section 5-6).
6. Rotate the applicable OUTPUT Control (panel or remote) to the desired position (see Section 5-3).
7. Rotate the ARC CONTROL to the zero.
8. Wear dry insulating gloves and clothing, and wear welding helmet with proper filter lens according to ANSI Z49.1.

9. Prepare for welding as follows:
  - a. Connect work clamp to clean, bare metal at workpiece.
  - b. Select and obtain proper tungsten electrode.
  - c. Prepare tungsten electrode and insert into torch.
10. Turn on shielding gas and water supplies as applicable.
11. Press the POWER switch ON button.
12. Begin welding.

### 6-3. SHIELDED METAL ARC WELDING (SMAW)



**WARNING: Read and follow safety information at beginning of entire Section 6 before proceeding.**

1. Install and connect unit according to Section 4.
2. Place the CONTACTOR switch in the ON position.
3. Place the CV/CC switch in the CC position.
4. Place the Output Control switch in the desired position (see Section 5-6).
5. Rotate the applicable OUTPUT Control (panel or remote) to the desired position (see Section 5-3).
6. Rotate the ARC CONTROL to the desired position (see Section 5-4A).
7. Wear dry insulating gloves and clothing, and wear welding helmet with proper filter lens according to ANSI Z49.1.
8. Prepare for welding as follows:
  - a. Connect work clamp to clean, bare metal at workpiece.
  - b. Select and obtain proper electrode, and insert into electrode holder.
9. Press the POWER switch ON button.
10. Begin welding.

### 6-4. SUBMERGED ARC WELDING (SAW)



**WARNING: Read and follow safety information at beginning of entire Section 6 before proceeding.**

1. Install and connect unit according to Section 4.
2. Install and prepare wire feeding system according to its Owner's Manual.
3. Install flux system according to its Owner's Manual.
4. Place the CONTACTOR switch in the OFF/REMOTE position.
5. Place the CV/CC switch in the desired position (see Section 5-7)..
6. Place the Output Control switch in the desired position (see Section 5-6).
7. Rotate the applicable OUTPUT Control (panel or remote) to the desired position (see Section 5-3).

8. Rotate the ARC CONTROL/INDUCTANCE CONTROL to the desired position (see Section 5-4).
9. Wear dry insulating gloves and clothing, and wear safety goggles with correct filter shade according to ANSI Z49.1.
10. Prepare for welding as follows:
  - a. Connect work clamp to clean, bare metal at workpiece.
  - b. Select and obtain proper welding wire, and thread as instructed in wire feeder Owner's Manual.
  - c. Select and obtain proper flux, and put into flux system.
11. Turn on flux supply valve as applicable.
12. Press the POWER switch ON button.
13. Begin welding.

### 6-5. AIR CARBON ARC CUTTING AND GOUGING (ACA)



**WARNING: Read and follow safety information at beginning of entire Section 6 before proceeding.**

1. Install and connect unit according to Section 4.
2. Connect compressed air supply to torch air hose.
3. Place the CV/CC switch in the desired position (see Section 5-7)..
4. Place the Output Control switch in the desired position (see Section 5-6).
5. Rotate the applicable OUTPUT Control (panel or remote) to the desired position (see Section 5-3).
6. Rotate the ARC CONTROL/INDUCTANCE CONTROL to the desired position (see Section 5-4).
7. Place the CONTACTOR switch in the ON position.
8. Wear dry insulating gloves and clothing, and wear welding helmet with proper filter lens according to ANSI Z49.1.
9. Prepare for cutting or gouging as follows:
  - a. Connect work clamp to clean, bare metal at workpiece.
  - b. Select and obtain proper carbon electrode, and insert into torch.
10. Press the POWER switch ON button.
11. Begin operation.

### 6-6. SHUTTING DOWN

1. Stop welding or cutting.
2. Press the welding power source POWER switch OFF button.
3. Turn off the shielding gas and water supplies if applicable.



**WARNING: HIGH CONCENTRATION OF SHIELDING GAS can harm health or kill.**

- Shut off gas supply when not in use.

4. Turn off flux supply and compressed air supply if applicable.

## SECTION 7 – MAINTENANCE & TROUBLESHOOTING

### 7-1. ROUTINE MAINTENANCE (Table 7-1)

**IMPORTANT:** Every six months inspect the labels on this unit for legibility. All precautionary labels must be maintained in a clearly readable state and replaced when necessary. See Parts List for part number of precautionary labels.



**WARNING: ELECTRIC SHOCK can kill.**

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

**MOVING PARTS can cause serious injury.**

- Keep away from moving parts.

**HOT SURFACES can cause severe burns.**

- Allow cooling period before servicing.

Maintenance to be performed only by qualified persons.

Table 7-1. Maintenance Schedule

| Frequency*      | Maintenance                                                                                    |
|-----------------|------------------------------------------------------------------------------------------------|
| Every month.    | Units in heavy service environments:<br>Check labels, weld cables, clean internal parts.       |
| Every 3 months. | Check weld cables (see Section 7-1B).                                                          |
| Every 6 months. | Check all labels (see IMPORTANT block, Section 7-1). Clean internal parts (see Section 7-1 C). |

\*Frequency of service is based on units operated 40 hours per week. Increase frequency of maintenance if usage exceeds 40 hours per week.

#### A. Fan Motors

This unit is equipped with two exhaust fans and relies on forced draft for adequate cooling. The fan motors are manufactured with lifetime sealed bearings and require no maintenance.

#### B. Weld Cables



**WARNING: Read and follow safety information at beginning of entire Section 7-1 before proceeding.**

Every three months inspect cables for breaks in insulation. Repair or replace cables if insulation breaks are present. Clean and tighten connections at each inspection.

### C. Internal Cleaning



**WARNING: Read and follow safety information at beginning of entire Section 7-1 before proceeding.**

Every six months blow out or vacuum dust and dirt from the inside of the welding power source. Do not remove the outer enclosure, but blow a clean, dry airstream through the cabinet louvers. If dusty or dirty conditions are present, clean the unit monthly.

### 7-2. OVERLOAD PROTECTION



**WARNING: ELECTRIC SHOCK can kill.**

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

**INCORRECT FUSE can damage unit.**

- Use only replacement fuse of same size, type, and rating (see Parts List).

#### A. Main Fuse F1 (Figure 7-1)



**WARNING: Read and follow safety information at beginning of entire Section 7-2 before proceeding.**

The unit is protected from overload by fuse F1 located on the center panel. If fuse F1 opens, the unit will be completely inoperative.

To replace F1, proceed as follows:

1. Remove the unit top cover.
2. Check F1, and replace if necessary.
3. Reinstall unit top cover.

#### B. Control Circuit Fuse F2 (Figure 7-1)

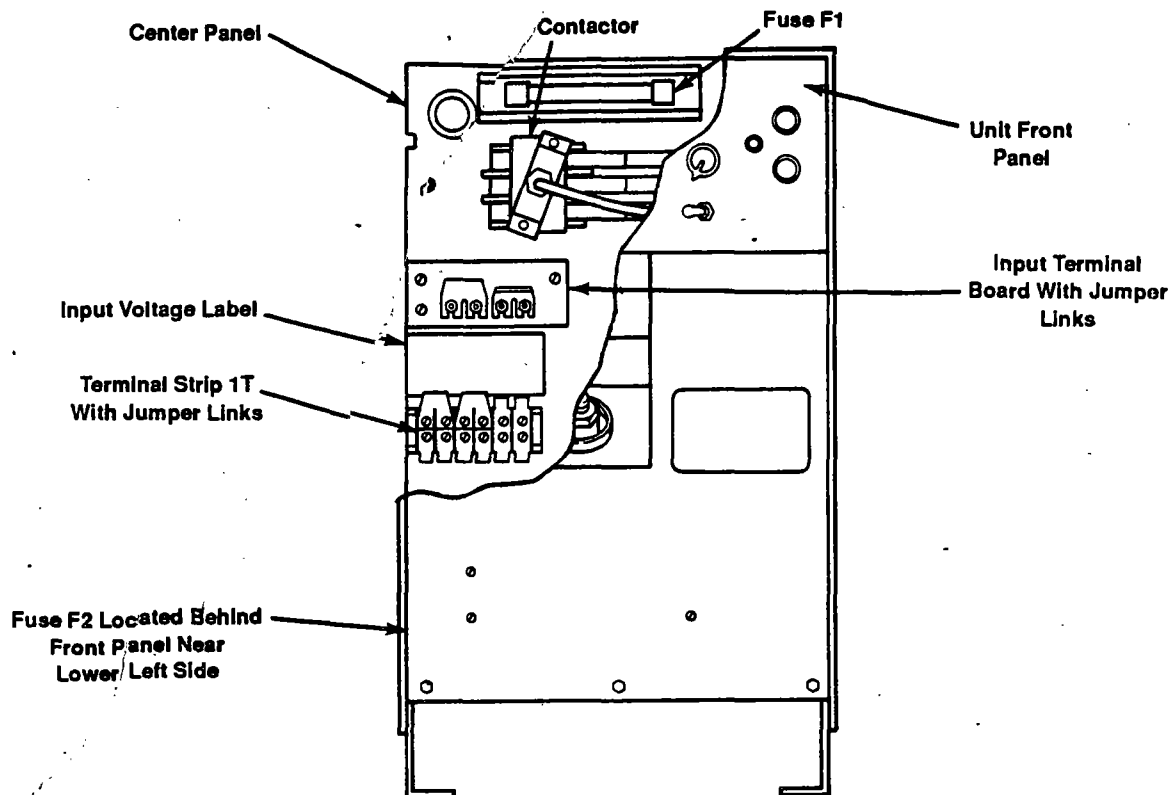


**WARNING: Read and follow safety information at beginning of entire Section 7-2 before proceeding.**

The power source rectifier SR1 is protected from overload by fuse F2 located behind the lower left portion of the front panel. Should F2 open, the CV/CC and CONTACTOR switches would not work.

To replace F2, proceed as follows:

1. Remove left side panel.
2. Check F2, and replace if necessary.
3. Reinstall left side panel.



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Figure 7-1. Component Locations

### C. Circuit Breaker CB1 (Figure 5-1)



**WARNING:** Read and follow safety information at beginning of entire Section 7-2 before proceeding.

Circuit Breaker CB1 is an automatic-trip type breaker and is not manually operable. When the circuit breaker button is in (ON position), the circuit breaker is functional. When the button is out (OFF position), the breaker is open and not functional.

If CB1 opens when equipment use begins, a fault is probably present in the equipment. If CB1 opens after prolonged equipment use, an overload condition is probably present. Should CB1 open, locate and correct the problem, and manually reset CB1.

### 7-3. THERMAL PROTECTION

Two normally closed thermostats TP1 are provided on the unit. One of these thermostats is located on each transistor module heat sink. A normally closed thermostat TP2 is provided on the output diode heat sink. All three thermostats are wired in series with the main contactor W coil. If any heat sink becomes too warm, the respective thermostat opens, W contacts open, and the unit completely shuts down (thermal overload). The thermostat(s) automatically close when the unit cools down. After a cooling period, press the POWER switch ON button to resume operation.

### 7-4. CIRCUIT BOARD INDICATOR LIGHTS



**WARNING:** ELECTRIC SHOCK can kill; MOVING PARTS can cause injury.

- Do not touch live electrical parts.
- Keep away from moving parts.

Only qualified persons familiar with and following standard safety practices are to inspect, maintain, or service this unit.

This unit uses fiber optics for transmitting control circuitry signals. The light wavelengths used are visible to the human eye. There is one unnumbered fiber optics cable from the control circuit board PC1 to each of the four individual base drive boards PC2 and PC3.

Each of the four base drive boards PC2 and PC3 are equipped with a red indicator light LED 50. The light will be on when the contactor is energized and the pulse width modulator chip on PC1 is operating. It is normal for the LED's 50 to be on during welding. The brightness of the LED's is proportional to machine output, and all LED's at any given time should have the same relative brightness.

Additionally, balance circuit board PC5, located next to main control circuit board PC1, is equipped with a red indicator light LED1. This light is normally off during operation. LED 1 only turns on when operating on 460 volts input power and a transistor module voltage imbalance occurs. If LED 1 is on, no machine open-circuit voltage will be available when the contactor is energized.

## 7-5. CIRCUIT BOARD HANDLING PROCEDURES



### **WARNING: ELECTRIC SHOCK can kill.**

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.



### **CAUTION: ELECTROSTATIC DISCHARGE (ESD) can damage circuit boards.**

- Put on properly grounded wrist strap **BEFORE** handling circuit boards.
- Transport circuit boards in proper static-shielding carriers or packages.
- Perform work only at a static-safe work area.

### **INCORRECT INSTALLATION or misaligned plugs can damage circuit board.**

- Be sure that plugs are properly installed and aligned.

### **EXCESSIVE PRESSURE can break circuit board.**

- Use only minimal pressure and gentle movement when disconnecting or connecting board plugs and removing or installing board.

## 7-6. TROUBLESHOOTING (Table 7-2)



### **WARNING: ELECTRIC SHOCK can kill.**

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

### **MOVING PARTS can cause serious injury.**

- Keep away from moving parts.

### **HOT SURFACES can cause severe burns.**

- Allow cooling period before servicing.

Troubleshooting to be performed only by qualified persons:

It is assumed that the unit was properly installed according to Section 4 of this manual, the operator is familiar with the function of controls, the welding power source was working properly, and that the trouble is not related to the welding process.

The following table is designed to diagnose and provide remedies for some of the troubles that may develop in this welding power source. Use this table in conjunction with the circuit diagram while performing troubleshooting procedures. If the trouble is not remedied after performing these procedures, contact the nearest Factory Authorized Service Station. In all cases of equipment malfunction, strictly follow the manufacturer's procedures and instructions.

**Table 7-2. Troubleshooting**

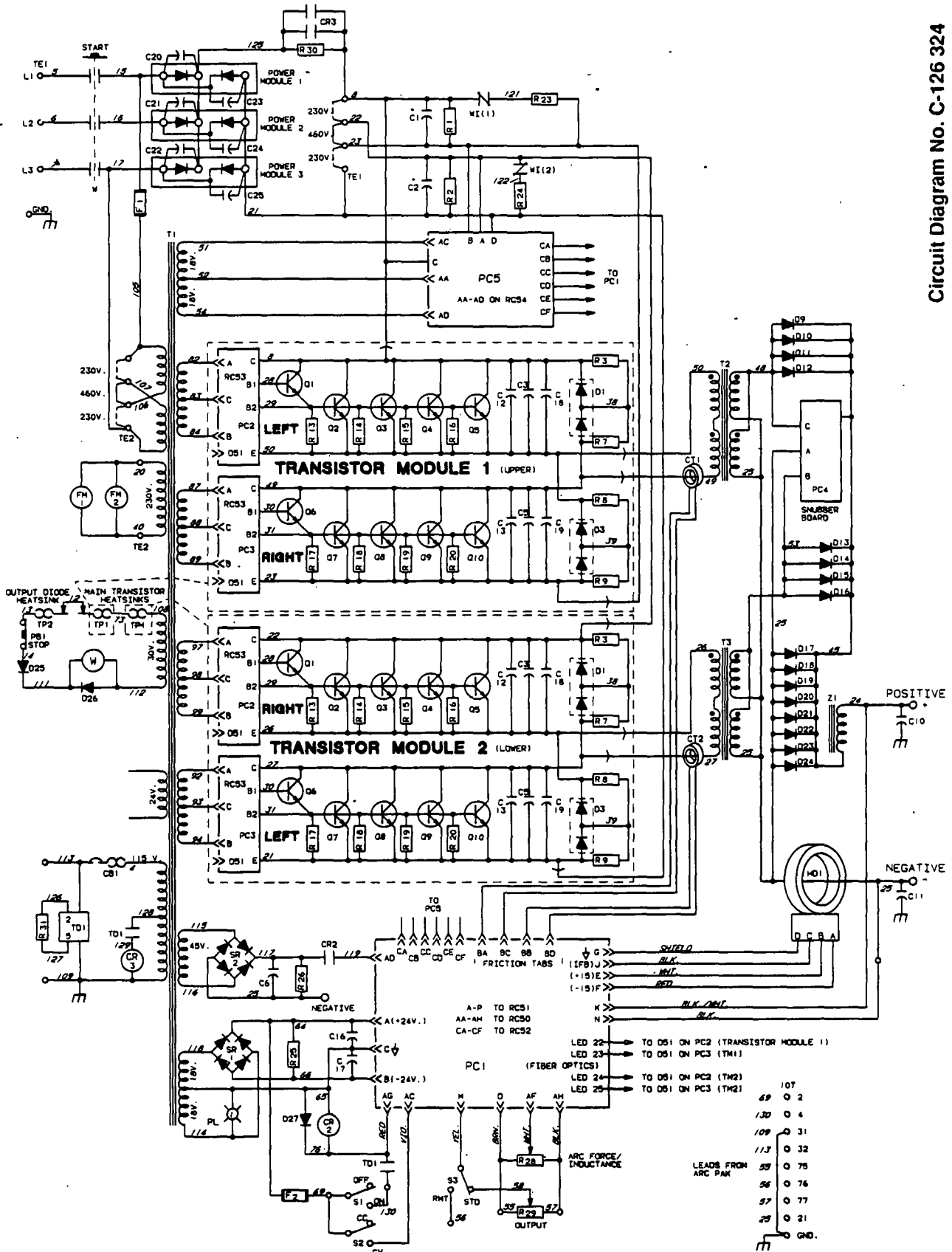
| <b>TROUBLE</b>                                                       | <b>PROBABLE CAUSE</b>                                                            | <b>REMEDY</b>                                                                                  |
|----------------------------------------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| No weld output; unit completely inoperative; pilot light PL1 not on. | Line disconnect switch in the OFF position.                                      | Place line disconnect switch in the ON position.                                               |
|                                                                      | Line fuse(s) open.                                                               | Check and replace line fuse(s).                                                                |
|                                                                      | Improper electrical input connections.                                           | See Section 4-4 for proper input connections.                                                  |
|                                                                      | Contactor W.                                                                     | Check W points for wear, and replace points if necessary.                                      |
|                                                                      | Fuse F1 open.                                                                    | Check and replace F1 if necessary (see Section 7-2).                                           |
|                                                                      | Unit overheating caused thermostat(s) TP1 and/or TP2 to open (thermal shutdown). | Allow unit to cool down (see Section 7-3).                                                     |
| No weld output; unit completely inoperative; pilot light PL1 on.     | Line voltage too high or too low ( $\pm 10\%$ is maximum fluctuation tolerated). | Contact local electric utility to check and correct line voltage problems.                     |
|                                                                      | Transistor module voltage imbalance.                                             | Check status of LED 1 on PC5 according to Section 7-4, and contact factory Service Department. |

**Table 7-2. Troubleshooting (Continued)**

|                                                                                                            |                                                                   |                                                                                                           |
|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Reduced output voltage; only one-half of unit output voltage available; one transistor module inoperative. | Input voltage jumper links connected for incorrect input voltage. | See Section 4-4 for proper connections.                                                                   |
|                                                                                                            | Poor and/or improper input and/or output connections.             | See Sections 4-4 and 4-3 for proper input and output connections.                                         |
|                                                                                                            | Base drive circuit board(s) PC2 and/or PC3 inoperative.           | Check status of LED's on PC2 and/or PC3 according to Section 7-4, and contact factory Service Department. |
|                                                                                                            | Improper fiber optic connection.                                  | Contact factory Service Department.                                                                       |
| Erratic or improper weld output                                                                            | Incorrect welding cable size.                                     | Use proper size and type of cable (see Section 4-3).                                                      |
|                                                                                                            | Loose or dirty welding cable connections.                         | Clean and tighten all welding connections.                                                                |
|                                                                                                            | Poor and/or improper input and/or output connections.             | See Sections 4-4 and 4-3 for proper input and output connections.                                         |
|                                                                                                            | Improper wire feeding setup, if applicable.                       | See Installation Section in wire feeder Owner's Manual.                                                   |
| CV/CC and CONTACTOR switches inoperative.                                                                  | Fuse F2 open.                                                     | Check and replace F2 if necessary (see Section 7-2).                                                      |
| Reduced output voltage; only one-half of unit output voltage available.                                    | Base drive circuit board(s) PC2 and/or PC3 inoperative.           | Check status of LED's on PC2 and/or PC3 according to Section 7-4, and contact factory Service Department. |

## NOTES

## SECTION 8 - ELECTRICAL DIAGRAMS



Circuit Diagram No. C-126 324

Diagram 8-1. Circuit Diagram

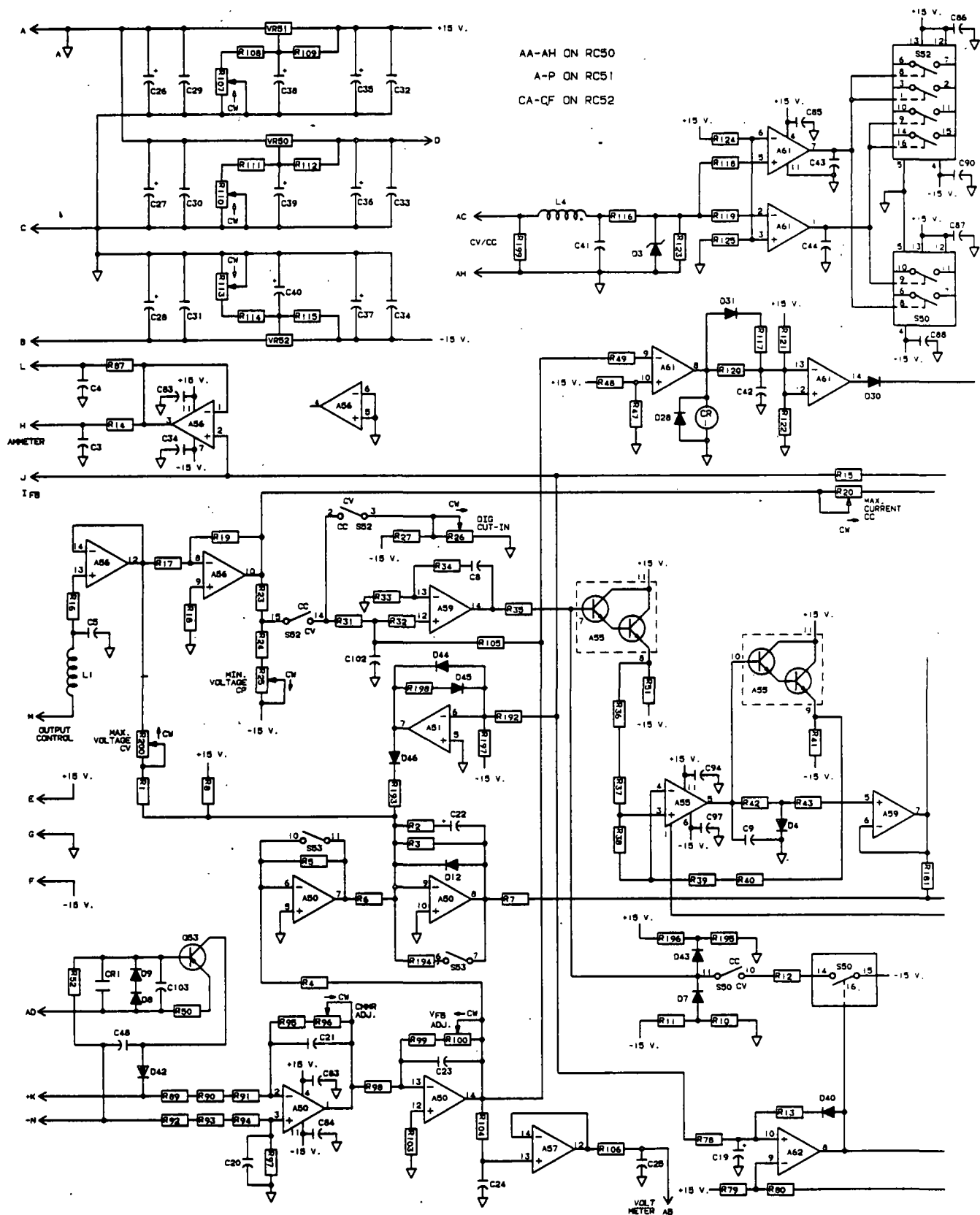
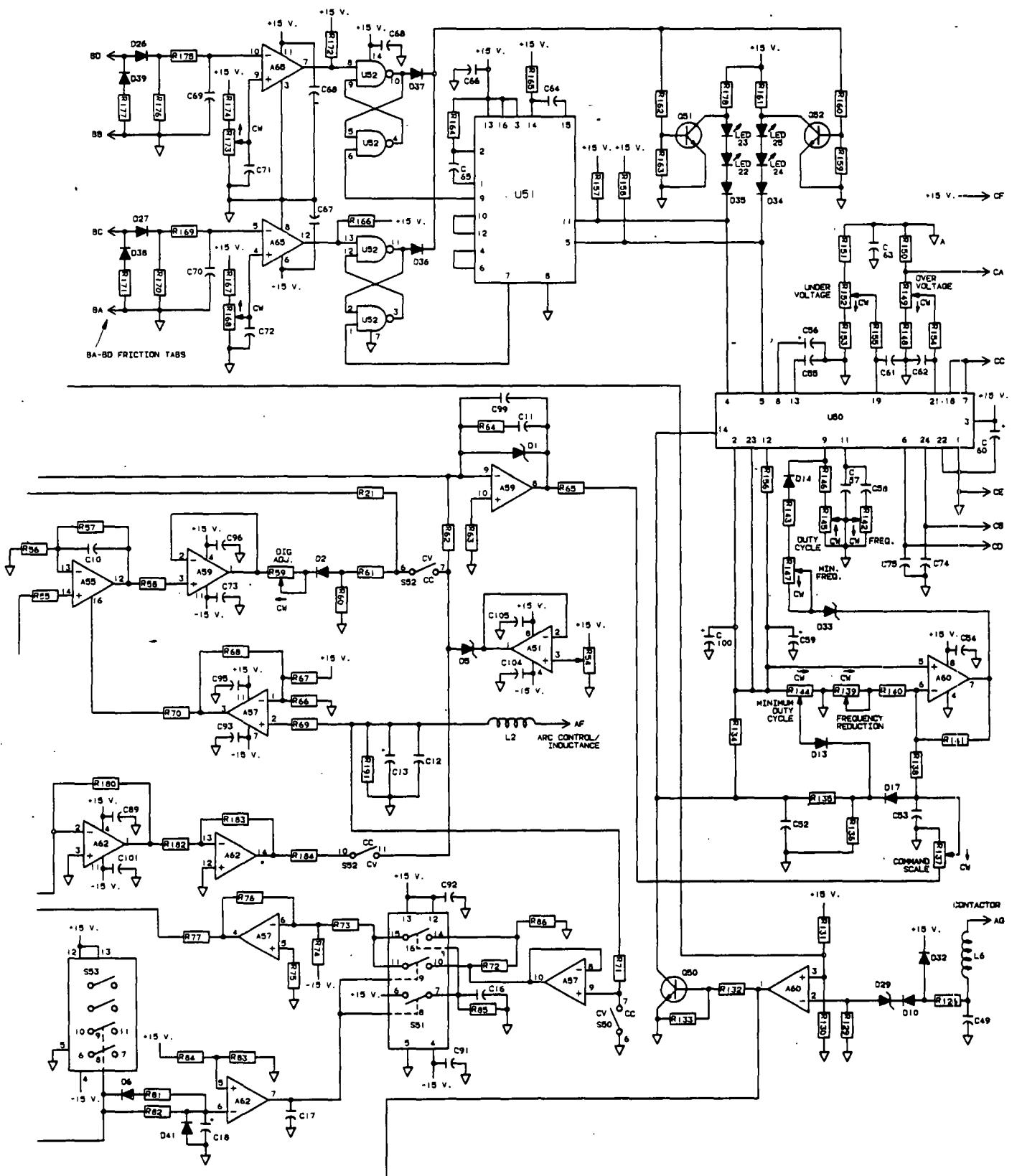
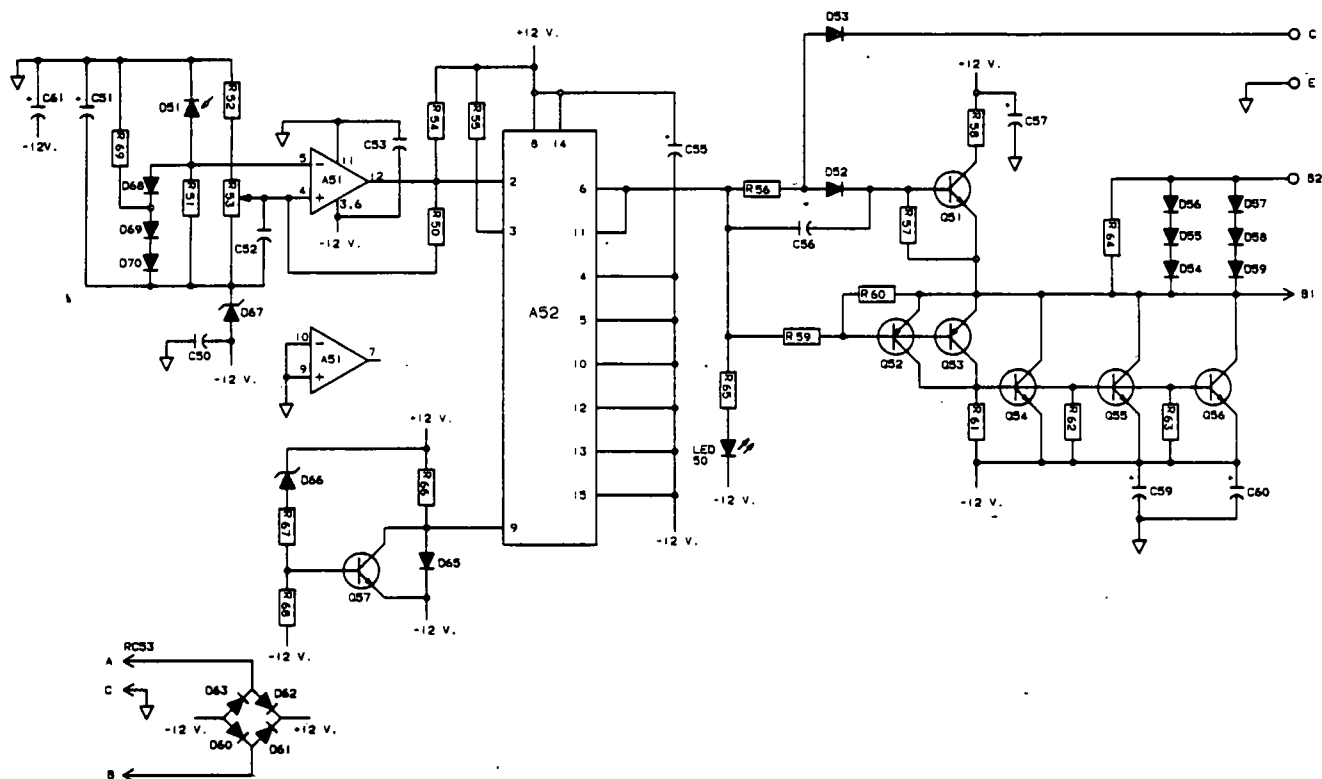


Diagram 8-2. Circuit Diagram For Control Circuit Board PC1

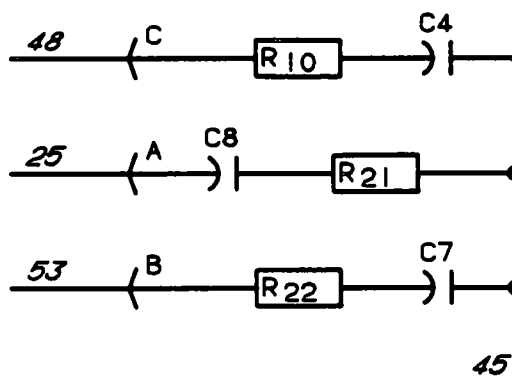


Circuit Diagram No. D-119 151



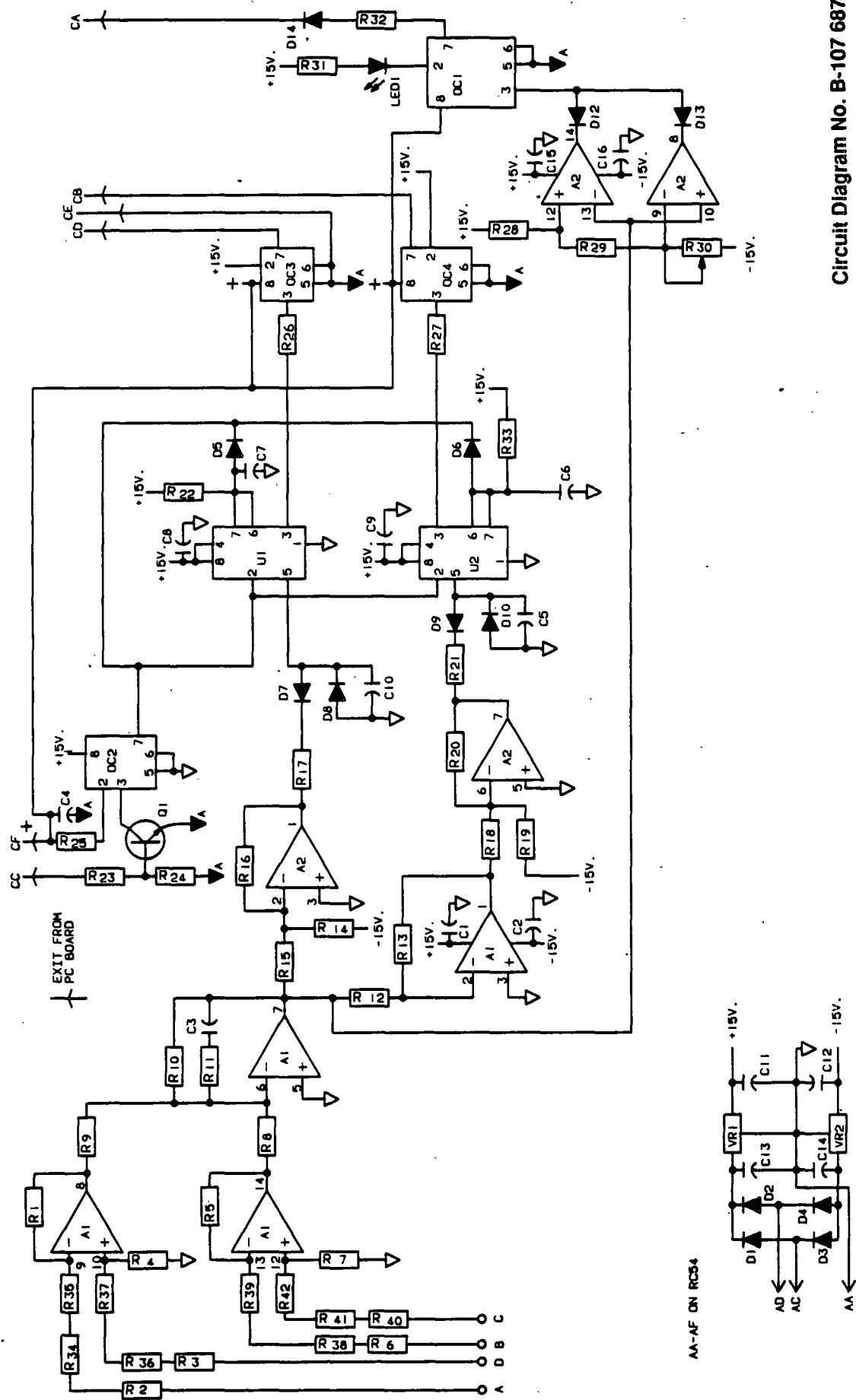
Circuit Diagram No. B-122 636

Diagram 8-3. Circuit Diagram For Base Drive Circuit Boards PC2 And PC3



Circuit Diagram No. A-123 501

Diagram 8-4. Circuit Diagram For Snubber Circuit Board PC4



Circuit Diagram No. B-107 687

# SECTION 9 - PARTS LIST

TD-096 969-C

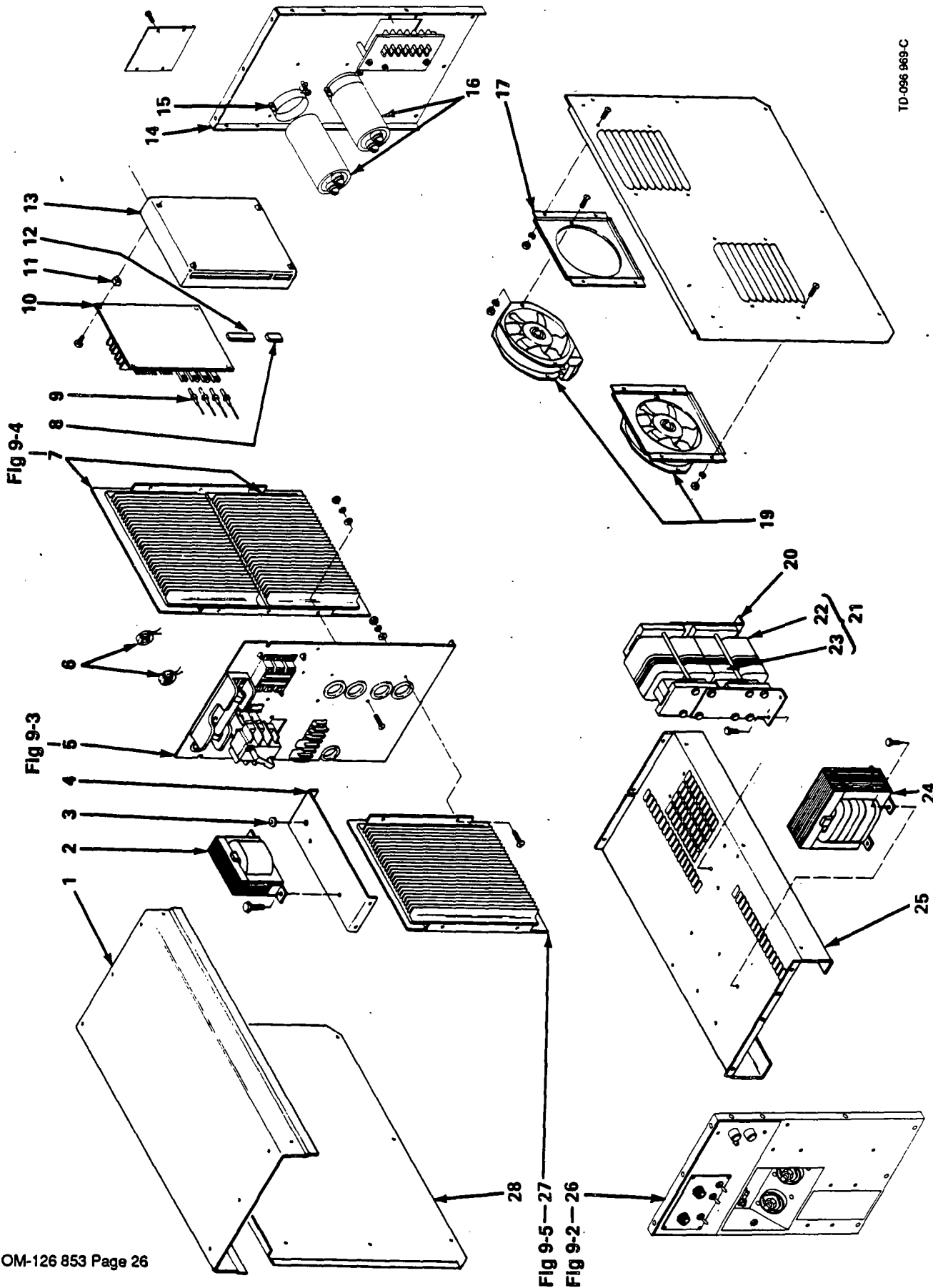


Figure 9-1. Main Assembly

| Item No.                         | Dia. Mkgs. | Part No.       | Description                                             | Quantity |
|----------------------------------|------------|----------------|---------------------------------------------------------|----------|
| <b>Figure 9-1. Main Assembly</b> |            |                |                                                         |          |
| 1                                |            | 109 005        | COVER, top                                              | 1        |
| 2                                | Z1         | 098 451        | STABILIZER                                              | 1        |
| 3                                |            | 010 116        | GROMMET, rbr .375 ID x .500                             | 1        |
| 4                                |            | 096 462        | BAFFLE, air                                             | 1        |
| 5                                |            | Fig 9-3        | BAFFLE, center w/components                             | 1        |
| 6                                | CT1,2      | 096 659        | TRANSFORMER, current                                    | 2        |
| 7                                | TM1,2      | 122 950        | TRANSISTOR ASSEMBLY, main (Fig 9-4)                     | 2        |
| 8                                | RC50       | 072 566        | HOUSING, term header 8 pin                              | 1        |
| 9                                |            | 097 474        | CABLE, fiber optics w/plugs                             | 4        |
| 10                               | PC1        | 119 219        | CIRCUIT CARD, control                                   | 1        |
| 11                               |            | 080 509        | GROMMET, scr No. 8/10                                   | 5        |
| 12                               | RC51       | 081 380        | HOUSING, term header 14 pin                             | 1        |
| 13                               |            | 096 430        | PANEL, mtg circuit card                                 | 1        |
| 14                               |            | 1186730008626  | PANEL, rear                                             | 1        |
|                                  |            | +1065370008626 | PLATE, cover terminal assembly                          | 1        |
|                                  |            | 124 245        | LABEL, warning electric shock can kill etc              | 1        |
| 15                               |            | 0345870008398  | TERMINAL ASSEMBLY, primary (consisting of)              | 1        |
|                                  |            | 083 426        | · TERMINAL BOARD, primary                               | 1        |
|                                  |            | 601 835        | · NUT, brs hex 10-32 reg                                | 6        |
|                                  |            | 601 836        | · NUT, brs hex .250-20 jam hvy                          | 2        |
|                                  |            | 038 888        | · STUD, primary board brs .250-20 x 1.500               | 1        |
|                                  |            | 038 887        | · STUD, primary board brs 10-32 x 1.375                 | 3        |
|                                  |            | 010 913        | · WASHER, flat brs .187 ID x .500 OD                    | 3        |
|                                  |            | 010 915        | · WASHER, flat brs .250 ID x .625 OD                    | 2        |
|                                  |            | 010 957        | TUBING, stl .500 OD x 17ga wall (mtg terminal assembly) | 2        |
| 16                               | C1,2       | 111 019        | CAPACITOR, elctlt 2500uf 450VDC pair                    | 1        |
|                                  |            | 022 160        | CLAMP, capacitor 3.000 dia                              | 2        |
| 17                               |            | 096 601        | BRACKET, mtg fan motor                                  | 2        |
| 18                               |            | 109 004        | PANEL, side RH                                          | 1        |
| 19                               | FM1,2      | 124 175        | FAN, motor 230V 50/60 Hz (consisting of)                | 2        |
|                                  |            | 120 131        | · HOUSING, plug nyl 2 contacts                          | 1        |
|                                  |            | 117 037        | HOUSING, term heater 2skt                               | 2        |
| 20                               |            | 096 454        | BRACKET, mtg transformer                                | 2        |
| 21                               | T2,3       | 124 419        | TRANSFORMER, power main 320 (consisting of)             | 2        |
| 22                               |            | 124 416        | · COIL, pri/sec 320 bottom                              | 1        |
| 23                               |            | 124 415        | · COIL, pri/sec 320 top                                 | 1        |
| 24                               | T1         | 124 152        | TRANSFORMER, KVA 1/2 115-230-230/230-4                  | 1        |
| 25                               |            | 096 427        | BASE                                                    | 1        |
| 26                               |            | Fig 9-2        | PANEL, front w/components                               | 1        |
| 27                               |            | 098 173        | DIODE MODULE (Fig 9-2)                                  | 1        |
| 28                               |            | 096 423        | PANEL, side LH                                          | 1        |

+When ordering a component originally displaying a precautionary label, the label should also be ordered.  
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

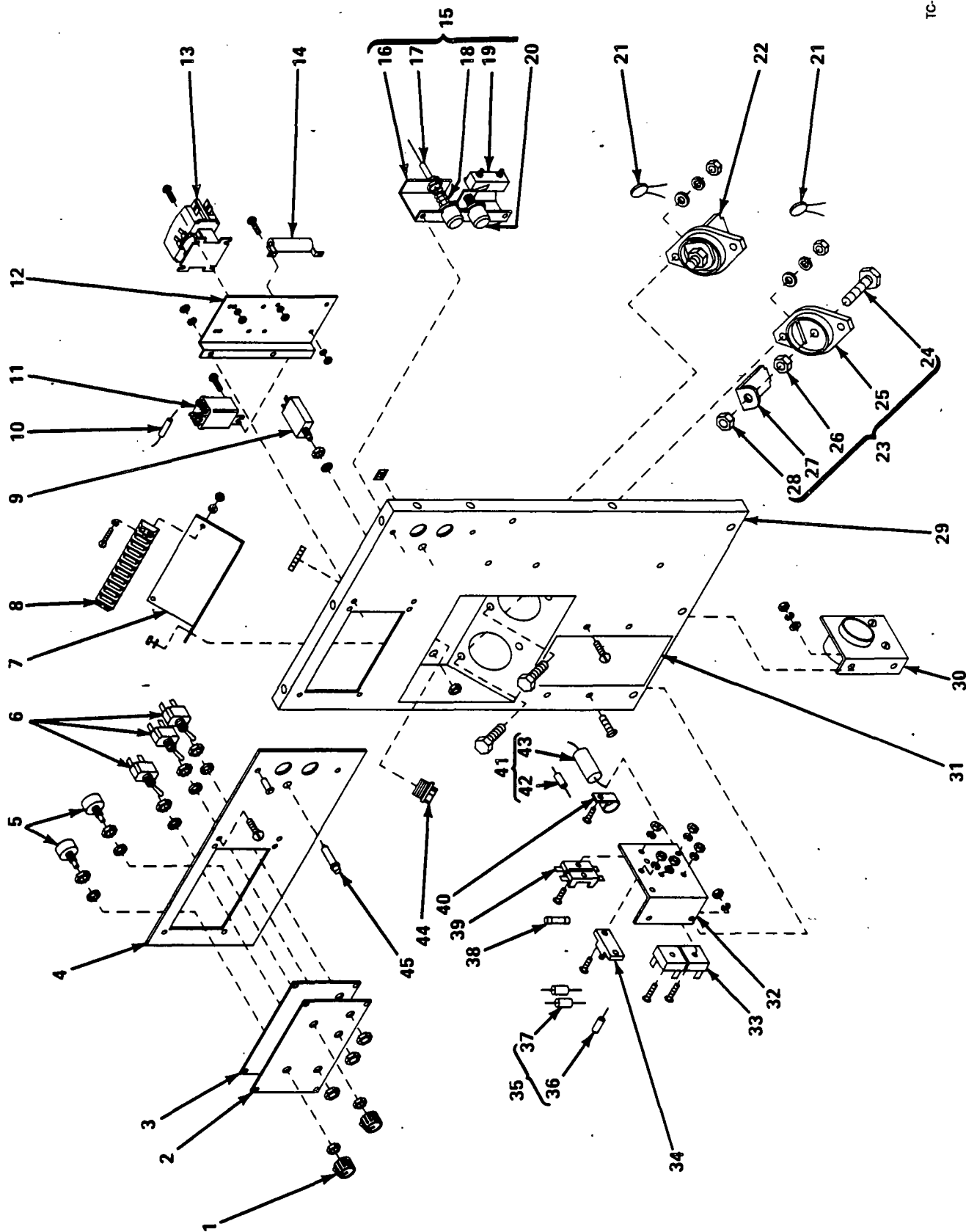


Figure 9-2. Panel, Front W/Components

| Item No.                                                       | Dia. Mkgs. | Part No.       | Description                                 | Quantity |
|----------------------------------------------------------------|------------|----------------|---------------------------------------------|----------|
| <b>Figure 9-2. Panel, Front W/Components (Fig 9-1 Item 26)</b> |            |                |                                             |          |
| 1                                                              |            | 097 922        | KNOB, pointer                               | 2        |
| 2                                                              |            | 126 600        | PLATE, control panel                        | 1        |
| 3                                                              |            | 0937270008398  | PANEL, mtg components                       | 1        |
| 4                                                              |            |                | NAMEPLATE, (order by model & serial number) | 1        |
| 5                                                              | R28,29     | 035 897        | POTENTIOMETER, C sltd sft 1/T 2W 1K ohm     | 2        |
| 6                                                              | S1-3       | 011 609        | SWITCH, tgl SPDT 15A 125VAC                 | 3        |
| 7                                                              |            | 1224460008398  | BRACKET, mtg block terminal                 | 1        |
| 8                                                              | 10T        | 038 782        | BLOCK, term 20A 10P                         | 1        |
| 9                                                              | CB1        | 011 991        | CIRCUIT BREAKER, man reset 1P 1.5A 250V     | 1        |
| 10                                                             | R31        | 030 047        | RESISTOR, C .5W 39K ohm                     | 1        |
| 11                                                             | TD1        | 047 133        | RELAY, delay adj 120VAC DPDT                | 1        |
| 12                                                             |            | 1224420008398  | BRACKET, mtg relay                          | 1        |
| 13                                                             | CR3        | 108 358        | CONTACTOR, def prp 25A 2P 24VAC coil        | 1        |
| 14                                                             | R30        | 030 087        | RESISTOR, WW fxd 25W 200 ohm                | 1        |
| 15                                                             | PB1        | 105 572        | SWITCH, pb (consisting of)                  | 1        |
| 16                                                             |            | 081 008        | · BRACKET, mtg switch                       | 1        |
| 17                                                             |            | 090 354        | · PUSH BUTTON SET, w/cable & housing        | 1        |
| 18                                                             |            | 018 606        | · SPRING, compression                       | 1        |
| 19                                                             |            | 027 878        | · SWITCH, limit - leaf actuating SPDT       | 1        |
| 20                                                             |            | 059 885        | · BUTTON, push reset red                    | 1        |
| 21                                                             | C10,11     | 087 209        | CAPACITOR, cer disc .003uf 2000VAC          | 2        |
| 22                                                             |            | 039 047        | TERMINAL, pwr output red (consisting of)    | 1        |
|                                                                |            | 039 046        | TERMINAL, pwr output black (consisting of)  | 1        |
| 23                                                             |            | 601 976        | · SCREW, cap hex hd 1/2-13 x 1-1/2          | 1        |
| 24                                                             |            | 039 049        | · TERMINAL BOARD, red                       | 1        |
| 25                                                             |            | 039 045        | · TERMINAL BOARD, black                     | 1        |
| 26                                                             |            | 601 880        | · NUT, hex jam 1/2-13                       | 1        |
| 27                                                             |            | 039 044        | · BUS BAR                                   | 1        |
| 28                                                             |            | 601 879        | · NUT, hex full 1/2-13                      | 1        |
| 29                                                             |            | +1186710008625 | PANEL, front                                | 1        |
| 30                                                             | HD1        | 106 353        | SENSOR, current                             | 1        |
| 31                                                             |            | 121316         | LABEL, warning general precautionary        | 1        |
| 32                                                             |            | 108 830        | BRACKET, mtg rectifier                      | 1        |
| 33                                                             | SR1,2      | 035 704        | RECTIFIER, integrated 30A 600V              | 2        |
| 34                                                             |            | 072 253        | STUD, grd 10-32 x 1/2                       | 1        |
| 35                                                             |            | 090 476        | CAPACITOR ASSEMBLY, (consisting of)         | 1        |
| 36                                                             | R25        | 601 394        | · RESISTOR, C 2W 10K ohm                    | 1        |
| 37                                                             | C16,17     | 000 859        | · CAPACITOR, elctlt 220uf 35VDC             | 2        |
| 38                                                             | F2         | *012 643       | FUSE, minat gl slo blo 1A                   | 1        |
| 39                                                             |            | 093 376        | HOLDER, fuse minat                          | 1        |
| 40                                                             |            | 010 311        | CLAMP, nyl .875 clamp dia x .500            | 1        |
| 41                                                             |            | 099 596        | CAPACITOR ASSEMBLY, (consisting of)         | 1        |
| 42                                                             | R26        | 601 934        | · RESISTOR, C 2W 10K ohm                    | 1        |
| 43                                                             | C6         | 031 613        | · CAPACITOR, elctlt 100uf 150VDC            | 1        |
| 44                                                             |            | 010 610        | CONNECTOR, clamp cable .500                 | 1        |
| 45                                                             | PL1        | 048 573        | LIGHT, ind red lens 28V                     | 1        |

+When ordering a component originally displaying a precautionary label, the label should also be ordered.

\*Recommended Spare Parts.

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

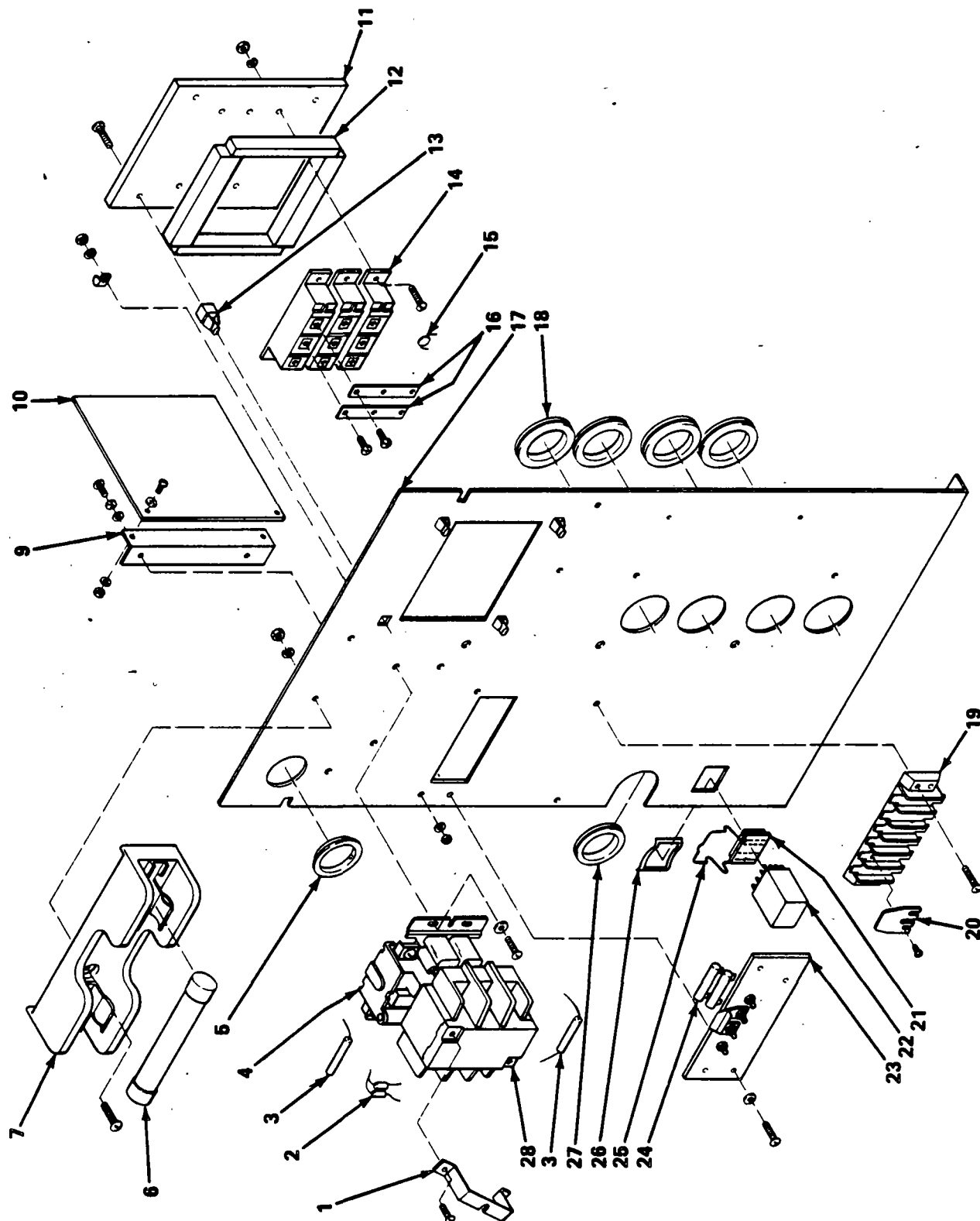
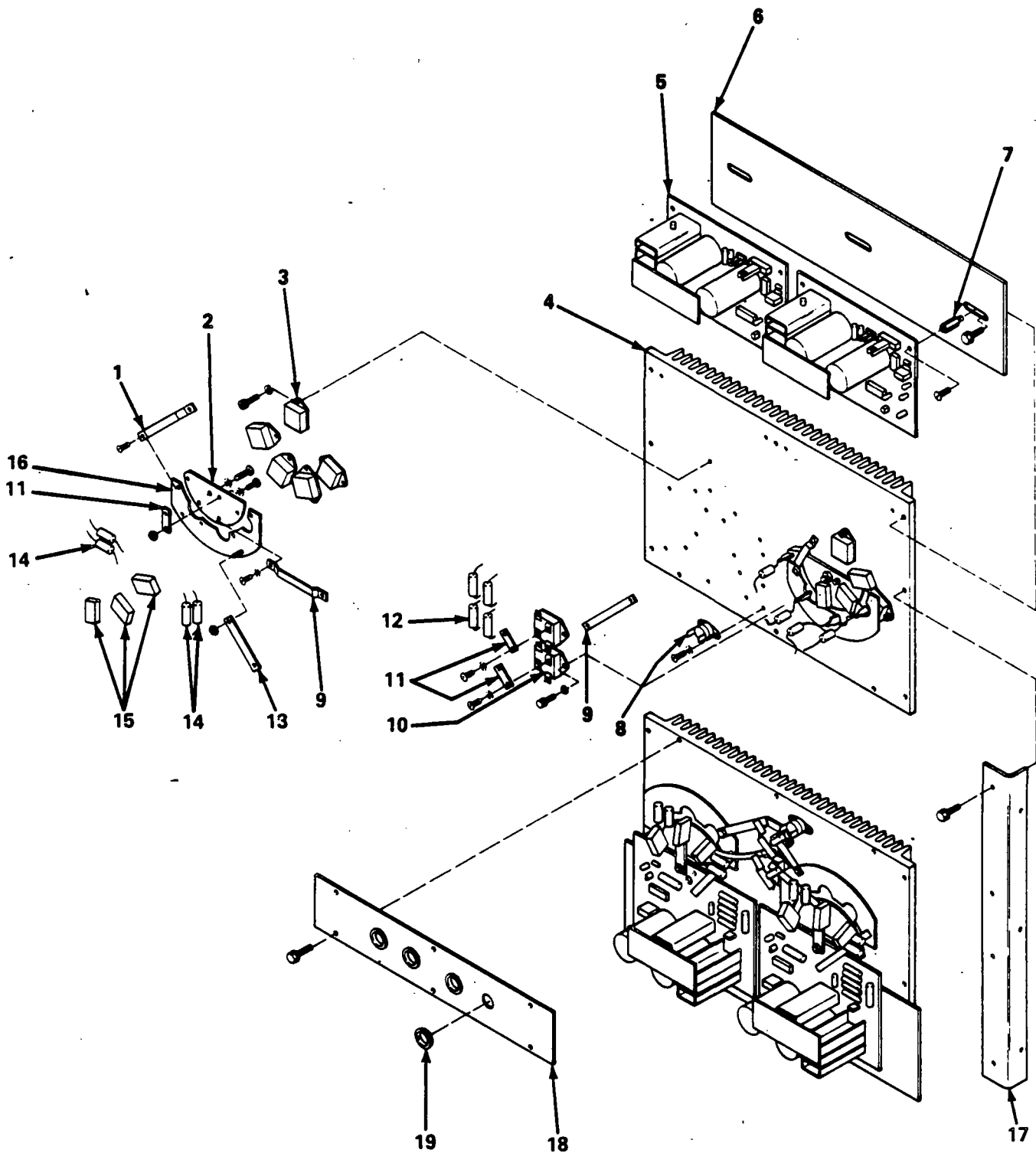


Figure 9-3. Baffle, Center W/Components

| Item No.                                                        | Dia. Mkgs. | Part No. | Description                                            | Quantity |
|-----------------------------------------------------------------|------------|----------|--------------------------------------------------------|----------|
| <b>Figure 9-3. Baffle, Center W/Components (Fig 9-1 Item 5)</b> |            |          |                                                        |          |
| 1                                                               |            | 081 016  | BRACKET, mtg                                           | 1        |
| 2                                                               |            | 082 456  | DIODE ASSEMBLY, (consisting of)                        | 1        |
|                                                                 | D25,26     | 070 250  | · DIODE, 3A 600V                                       | 2        |
| 3                                                               | R23,24     | 098 975  | RESISTOR, WW fxd 10W 500 ohm                           | 1        |
| 4                                                               | W11,2      | 034 896  | INTERLOCK, crtor NC                                    | 2        |
| 5                                                               |            | 057 358  | BUSHING, snap-in nyl 1.000 ID x 1.375 mtg hole         | 1        |
| 6                                                               | F1         | *012 639 | FUSE, crtg 6A 600V                                     | 1        |
| 7                                                               |            | 070 404  | HOLDER, fuse crtg                                      | 1        |
| 9                                                               |            | 108 831  | ANGLE, mtg components                                  | 1        |
| 10                                                              | PC5        | 107 597  | CIRCUIT CARD, balance                                  | 1        |
| 11                                                              |            | 096 517  | HEAT SINK                                              | 1        |
| 12                                                              |            | 096 759  | WEATHERSTRIPPING, adhesive rbr 1/2 x 1/2 (order by ft) | 2ft      |
| 13                                                              |            | 080 509  | GROMMET, scr No. 8/10 panel hole                       | 4        |
| 14                                                              | PM1-3      | 095 279  | DIODE, power module 55A 1400V                          | 3        |
| 15                                                              | C20-25     | 087 337  | CAPACITOR, cer disc .003uf 3000VAC                     | 6        |
| 16                                                              |            | 096 606  | BUS BAR, jumper pri                                    | 2        |
| 17                                                              |            | 118 153  | BAFFLE, center                                         | 1        |
|                                                                 |            | 015 712  | GROMMET, rbr .625 ID x .875 mtg hole                   | 1        |
| 18                                                              |            | 015 722  | GROMMET, 1-1/4 ID x 1-1/2 mtg hole                     | 4        |
| 19                                                              | TE2        | 038 639  | BLOCK, term 30A 6P                                     | 1        |
| 20                                                              |            | 038 620  | LINK, jumper                                           | 2        |
|                                                                 |            | 120 561  | CONNECTOR, term block 20A                              | 10       |
| 21                                                              |            | 027 811  | SOCKET, relay                                          | 1        |
|                                                                 | D27        | 026 202  | DIODE, 1A 400V SP                                      | 1        |
| 22                                                              | CR2        | 027 810  | RELAY, encl 24VDC 4PDT                                 | 1        |
| 23                                                              | TE1        | 108 842  | TERMINAL ASSEMBLY, pri 1ph 2V (consisting of)          | 1        |
|                                                                 |            | 096 463  | · TERMINAL BOARD                                       | 1        |
|                                                                 |            | 038 887  | · STUD, brs No. 10-32 x 1-3/8                          | 4        |
|                                                                 |            | 601 835  | · NUT, brs hex 10-32                                   | 8        |
|                                                                 |            | 010 913  | · WASHER, flat brs 3/16 ID x 1/2 OD                    | 4        |
|                                                                 |            | 038 618  | · LINK, jumper                                         | 2        |
|                                                                 |            | 026 754  | · INSULATION, pri stud barrier                         | 4        |
| 24                                                              | R1,2       | 098 864  | RESISTOR, WW fxd 10W 20K ohm                           | 2        |
| 25                                                              |            | 079 844  | SPRING, holddown relay                                 | 1        |
| 26                                                              |            | 048 029  | CLIP, retaining socket relay                           | 1        |
| 27                                                              |            | 603 097  | GROMMET, rbr .843 ID x 1.250 mtg hole                  | 1        |
| 28                                                              | W          | 111 461  | CONTACTOR, 50A 3P 120V (consisting of)                 | 1        |
|                                                                 |            | 028 982  | · COIL                                                 | 1        |
|                                                                 |            | *003 567 | · KIT, point                                           | 3        |

\*Recommended Spare Parts.

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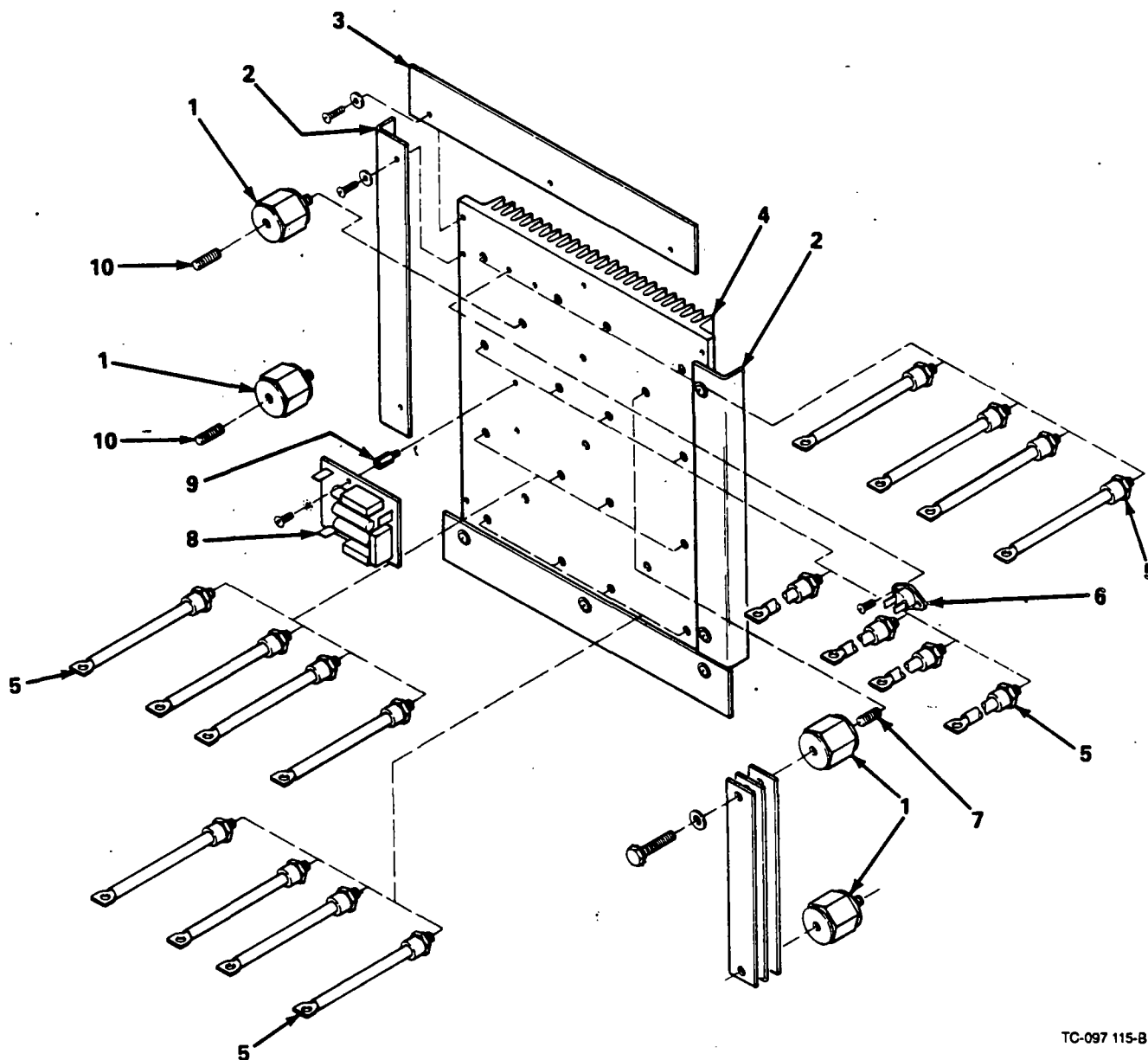
Ref. TD-097 114-B

Figure 9-4. Transistor Assembly, Main

| Item No.                                                              | Dia. Mkgs.       | Part No. | Description                                        | Quantity |
|-----------------------------------------------------------------------|------------------|----------|----------------------------------------------------|----------|
| <b>098 335 Figure 9-4. Transistor Assembly, Main (Fig 9-1 Item 7)</b> |                  |          |                                                    |          |
|                                                                       |                  | 122 949  | MODULE, (consisting of) .....                      | 2        |
| 1                                                                     |                  | 096 769  | · BUS BAR, driver board to collector bus bar ..... | 2        |
| 2                                                                     |                  | 122 931  | · BUS BAR, emitter .....                           | 2        |
| 3                                                                     | Q1-10            | 122 776  | · TRANSISTOR, NPN 30A 850V .....                   | 10       |
| 4                                                                     |                  | 122 930  | · HEAT SINK, transistor .....                      | 1        |
| 5                                                                     | PC2,3            | 126 102  | · CIRCUIT CARD, base drive .....                   | 2        |
| 6                                                                     |                  | 122 920  | · BAFFLE, air .....                                | 1        |
| 7                                                                     |                  | 098 691  | · STAND-OFF, No. 6-32 x 1/2 .....                  | 4        |
| 8                                                                     | TP1              | 032 810  | · THERMOSTAT, NC .....                             | 1        |
| 9                                                                     |                  | 096 766  | · BUS BAR, diode to emitter bus bar .....          | 2        |
| 10                                                                    | D1,3             | 095 254  | · DIODE, 30A 300V .....                            | 2        |
| 11                                                                    |                  | 096 770  | · BUS BAR, drive board to emitter bus bar .....    | 4        |
| 12                                                                    |                  | 125 844  | · RESISTOR ASSEMBLY, (consisting of) .....         | 2        |
|                                                                       | R3,7&8,9         | 113 781  | · RESISTOR, C 2W 100K ohm .....                    | 2        |
| 13                                                                    |                  | 126 109  | · BUS BAR, diode to collector bus bar .....        | 1        |
| 14                                                                    | R13-20           | 074 111  | · RESISTOR, C 2W 47 ohm .....                      | 4        |
| 15                                                                    | C3,5,12,13,18,19 | 098 325  | · CAPACITOR, poly film .027uf 630V .....           | 6        |
| 16                                                                    |                  | 126 108  | · BUS BAR, collector .....                         | 2        |
| 17                                                                    |                  | 122 923  | ANGLE, mtg heat sink .....                         | 2        |
| 18                                                                    |                  | 098 219  | BAFFLE, air & cable support .....                  | 1        |
| 29                                                                    |                  | 094 300  | BUSHING, snap-in 5/8 OD x 1/2 ID .....             | 4        |
|                                                                       |                  | 098 252  | BUS BAR, cap to emitter 3/16 x 3/8 x 4-3/8 .....   | 1        |
|                                                                       |                  | 098 253  | BUS BAR, cap to emitter 3/16 x 3/8 x 5-1/8 .....   | 1        |
|                                                                       |                  | 098 254  | BUS BAR, cap to collector 3/16 x 3/8 x 4 .....     | 1        |
|                                                                       |                  | 098 255  | BUS BAR, cap to collector 3/16 x 3/8 x 3-3/4 ..... | 1        |
|                                                                       |                  | 010 885  | STRIP, conductor .031 x .375 x 5.375 .....         | 1        |

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| Item No.                                                       | Dia. Mkgs. | Part No. | Description                      | Quantity |
|----------------------------------------------------------------|------------|----------|----------------------------------|----------|
| <b>098 173     Figure 9-5. Module, Diode (Fig 9-1 Item 27)</b> |            |          |                                  |          |
| 1                                                              |            | 026 947  | STAND-OFF, 1/4-20 x 1 .....      | 4        |
| 2                                                              |            | 096 604  | ANGLE, mtg heat sink diode ..... | 2        |
| 3                                                              |            | 096 603  | STRIP, mtg components .....      | 2        |
| 4                                                              |            | 096 421  | HEAT SINK, diodes .....          | 1        |
| 5                                                              | D9-24      | 095 251  | DIODE, 70A 400V .....            | 16       |
| 6                                                              | TP2        | 032 810  | THERMOSTAT, NC .....             | 1        |
| 7                                                              |            | 052 413  | STUD, brs 1/4-20 x 7/8 .....     | 4        |
| 8                                                              | PC4        | 098 154  | CIRCUIT CARD, snubber .....      | 1        |
| 9                                                              |            | 098 691  | STAND-OFF, No. 6-32 x 1/2 .....  | 2        |
| 10                                                             |            | 038 328  | STUD, brs 1/4-20 x 1-1/4 .....   | 2        |



TC-097 115-B

**Figure 9-5. Module, Diode**

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